APPLICATION		
DASH NO.	NEXT ASSY	USED ON
-501		69000940 69000941 69000942

TITLE SHEET

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REVISIONS - ALL SHEETS ARE SAME REVISION STATUS

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Installation Manual for the MKV-A EGPWS, P/N 6900094x

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1.0 INTRODUCTION

The purpose of this document is to provide guidance, information, and instructions to assist the installer with the design of the installation for the MKV-A EGPWC (Enhanced Ground Proximity Warning Computer). The MKV-A EGPWC, with one of the part numbers listed below, is the computer that is the central element of the Enhanced Ground Proximity Warning System (EGPWS).

- 69000940-[ ] (starting with -101)
- 69000941-[ ] (starting with -101)
- 69000942-[ ] (starting with -151)

2.0 SCOPE

This document provides an overview of a typical EGPWS system installation including self-test and override switches, indicator lamps, terrain displays, speaker and/or audio panel interfaces. Generic system block diagrams, including interfaces to control panels and displays, and sample wiring diagrams are included.

Interface details for specific aircraft types are contained in the Interface Control Document for the MKV-A EGPWS listed in Section 3.0. In addition to this installation manual, the installer needs to have the ICD available in order to determine the details for the particular aircraft type that is being configured.

Maintenance aspects of the installation such as Self-Test, fault isolation and troubleshooting are contained in the Line Maintenance Manual for the MKV-A EGPWS listed in Section 3.0.

For a complete description of the system functions, see the Product Specification for the MKV-A EGPWS listed in Section 3.0.

This document is intended to provide the information specified in TSO-C151c - 5.a.(6); TSO-C92c - d.(1)(iii), d.(1)(iv), and d.(1)(v); and TSO_C117a – h.(1)(iii), h.(1)(iv), and h.(1)(v).

3.0 REFERENCE DRAWINGS/DOCUMENTS

Document/Drawing Number	Document/Drawing Title
69000940	End Item, EGPWS, 115 VAC
69000941	End Item, EGPWS, 28 VDC
69000942	End Item, EGPWS, 115 VAC
HWS69000940-201	Outline Drawing, EGPWS, 115 VAC
HWS69000941-201	Outline Drawing, EGPWS, 28 VDC
HWS69000942-201	Outline Drawing, EGPWS, 115 VAC
SYS69000940-700	Interface Control Document for the MKV-A EGPWS
PDS69000940-000	Product Specification for the MKV-A EGPWS
PDS69000940-201	Line Maintenance Manual for the MKV-A EGPWS
PDS69000940-801	Pilot's Guide
SSA69000940-100	Functional Hazard Analysis for the MKV-Ax EGPWS
SSA69000940-301	Failure Modes and Effects Analysis (FMEA) for the MKV-A EGPWS
SWM69000940-802	BOSS User's Manual
SWM69000940-803	APD Tool User's Manual
060-4564-001	Product Description, SmartRunway®/SmartLanding® Functions of the Enhanced Ground Proximity Warning System
060-4314-082	RCD Selection Guide for the EGPWS Runway Awareness and Advisory System (RAAS)
060-4303-000	EGPWS Interface Methodology (KCPB Display)

4.0 LIST OF ABBREVIATIONS

The following acronyms may be used in this document:

APD	Aircraft Personality Database
BIT	Built In Test
EGPWC	Enhanced Ground Proximity Warning Computer
EGPWS	Enhanced Ground Proximity Warning System
FAA	Federal Aviation Administration
G/S	Glideslope
HW	Hardware
ICD	Interface Control Document
LRU	Line Replaceable Unit
MKV-A	Mark V-A EGPWS Warning Computer
MK V	Mark V EGPWS Warning Computer
N/A	Not Applicable
ND	Navigation Display
OSS	Option Selection Software
PC	Personal Computer
PFD	Primary Flight Display
RAAS	Runway Awareness and Advisory System
RCD	Reloadable Customer Definitions
RTCA	Requirements and Technical Concepts for Aviation
SW	Software
SYS	System
TAD	Terrain Awareness & Display
TAWS	Terrain Awareness Warning System
TBD	To Be Determined
TBC	To Be Confirmed
TCF	Terrain Clearance Floor
TSO	Technical Standard Order
VAC	Volts, Alternating Current
VDC	Volts, Direct Current
VSD	Vertical Situation Display

5.0 System Performance

The EGPWS operational performance will meet as a minimum the requirements of TSO-C92c, TSO-C117a, and TSO-C151c Class A. The actual performance is defined in the EGPWS Product Specification.

5.1 TSO Deviations

5.1.1 Mode 2 GPWS Alert Envelope (Lower maximum altitude from 1250 feet to 950 feet)

TSO-C151c requires performance to TSO-C92c and RTCA/DO-161A, Minimum Performance Standards – Airborne Ground Proximity Warning Equipment, dated May 27, 1976. Therefore, the following deviation applies to TSO-C151c as it applies to GPWS modes of operation. The EGPWS will deviate from this standard in that under specific conditions the EGPWS will lower the Mode 2 alert envelope maximum altitude from 1250 feet to 950.

The reason for this deviation is that aircraft are being allowed to fly with minimum radar vector altitudes that place the aircraft within 1000 feet AGL of terrain on approach. This causes Mode 2 nuisance alerts since the top of the Mode 2 alert envelope is set to 1250 feet. Thus, this deviation will reduce these nuisance alerts.

Honeywell has shown to the FAA that the implementation of this change provides an equivalent level of safety. In particular the lowering of the Mode 2 alert envelope does not turn off the Mode 2 alert algorithm. In addition, this envelope modification happens only if the TSO-C151c Look-ahead (TAWS) algorithms are active, with high quality terrain data in the area of the aircraft, and with very accurate vertical and horizontal position. Therefore, the aircraft is provided protection by the TAWS algorithms as well as the reduced Mode 2 alert envelope.

5.1.2 Mode 1 GPWS Alert Envelope (Raise lower cutoff from 10 feet to 130 feet)

TSO-C151c requires performance to TSO-C92c and RTCA/DO-161A, Minimum Performance Standards – Airborne Ground Proximity Warning Equipment, dated May 27, 1976. Therefore, the following deviation applies to TSO-C151c as it applies to GPWS modes of operation. The EGPWS will deviate from this standard in that under specific conditions the EGPWS will increase the cut-off floor of the Mode 1 alert envelope from 10 feet to 130 feet.

The reason for this deviation is to allow aircraft to perform allowed “steep approaches” to specific airports. For example, London City airport in England is known to be a problematic location. This change will allow configured aircraft to land using “steep approaches” without nuisance alerts.

Honeywell has shown to the FAA that the implementation of this change provides an equivalent level of safety. In particular the implementation includes the following:

- The flight crew must activate a dedicated “Steep Approach” switch in the flight deck.
- When selected, the switch will have a lighted annunciation on the switch.
- The aircraft must be flying in a configuration with specific slats/flaps, gear and speed brake settings.
- When active an aural “Standby” is provided at 125 and 95 feet and an aural “Flare” is provided at 75 feet.
- If a Mode 1 alert is present above 130 feet and remains active as the aircraft passes through 130 feet, the Mode 1 alert algorithm will remain active to 10 feet.
- The EGPWS performs fault monitoring of the steep approach select input.

Please note that this “Steep Approach” function is different from the standard EGPWS steep approach function which is selectable for all aircraft types. This specific steep approach mode is limited to specific aircraft models and is approved for the A320 family of aircrafts only. Consult the aircraft configuration data tables in the ICD.

5.1.3 Mode 7 Windshear Alerting (Gust conditions and shear intensity tests)

TSO-C117a specifies that when the equipment is subjected to an average shear intensity of $f_{ay,x} = 0.105$, an alert must be generated within 10 seconds. There are three occurrences of missed warning alerts when using

the Boeing windshear algorithm. All three occurrences of missed warning alerts for the Boeing windshear algorithm occurred when in the horizontal, decreasing energy orientation. The significant difference is that the missed alerts happened in the 'takeoff' mode, during which the Boeing algorithm shifts the alerting threshold slightly to desensitize the warning. For the three missed alerts, maximum computed shear was within .001 of the takeoff alert threshold. The Boeing windshear algorithm will only issue an alert if the threshold is exceeded. Therefore the missed alerts are consistent with the design of the algorithm.

TSO-C117a specifies that when the equipment is subjected to an average shear intensity of $f_{ay,x} = 0.21$, an alert must be generated within 5 seconds. The EGPWS will deviate from this standard in that, when the Honeywell Windshear algorithm is selected, alerts will be generated within 5.5 seconds when the aircraft is in the takeoff phase of flight.

Honeywell has shown that the Honeywell windshear algorithm provides an equivalent level of safety to the standards of the TSO. In particular, the algorithm has been shown to be performing as designed during takeoff conditions. The Honeywell windshear algorithm deviates from the TSO by small margins. The EGPWS windshear alerting functions meet the intent of the TSO with regard to unwanted, late or missed alerts.

5.1.4 Environmental Qualification Per DO-160G In Lieu of DO-160B/C

Honeywell has received concurrence from the FAA that environmental qualification to DO-160G can be used in lieu of DO-160C called out in TSO-C92c, and DO-160B called out in TSO-C117a. The use of DO-160G will provide an equivalent level of safety.

5.2 Enhancement to GPWS

The MKV-A EGPWS provides ground proximity warnings in accordance with RTCA/DO-161A. As part of this functionality there is an enhancement that has been implemented on specific aircraft types that support a tactical mode of operation.

To support tactical operations on these specific aircraft types, the basic Air Transport modes 1, 2, 3, 4, and 6 can be disabled and replaced with altered modes (performance curves) to prevent nuisance alerts during tactical operations. The use of Tactical Modes (performance curves) can only be performed on specific aircraft types and while a dedicated input discrete, configured as part of the aircraft type, is selected by the pilot.

If an aircraft type is selected that includes Tactical Modes, ensure that these modes are appropriate for the aircraft operations and that appropriate airworthiness approval is granted.

5.3 Non-TSO Functions

The MKV-A EGPWS includes functions that are not covered by a TSO approved minimum performance standard. These functions are considered as non-TSO functions. These added non-TSO functions do not affect or interfere with any required minimum performance standard of the MKV-A and do not violate any of its limitations.

The following chart lists the non-TSO functions that are integrated in the MKV-A EGPWS.

Related TSO Functional Category	Non-TSO Functions	SW Release Version	Comment
GPWS	**Bank Angle Callout** This option, enabled via program pin/APD/OSS, provides an aural advisory for excessive bank angles.	-101	See Product Specification
Customer Requested Advisory Alert	**V1 Callout** V1 callout option is enabled by program pin/APD/OSS. Provides aural output based on an ARINC 429 discrete input to the EGPWS	-101	See Product Specification
	Engine Fail Callout Engine Fail callout option is enabled by program pin/APD/OSS. Provides aural output based on an ARINC 429 discrete input to the EGPWS		
	Autopilot Disconnect Alert (Boeing) The Autopilot disconnect alert is enabled by program pin/APD/OSS and provides an aural alert if the autopilot is unexpectedly disconnected based on an ARINC 429 discrete input to the EGPWS. The aural message is "Autopilot Autopilot"	-101	See specific aircraft interface details in ICD.
TAWS	***AutoTilt™*** - This feature is an output from the EGPWC that can be used by compatible weather radars to assist in automatically calculating the optimum tilt angles for a scanning weather radar antenna.	-101	See Product Specification
Customer Requested Advisory Alert	**Speed Brake Alert** Alerts flight crew of incorrect speedbrake position with respect to current airplane configuration.	-101	See Product Specification
Customer Requested Advisory Alert	**Low Airspeed Monitor (737NG)** An "Airspeed Low, Airspeed Low" aural alert is issued when the aircraft airspeed decreases to below 70% of the amber band on the PFD speed tape.	-101	See Product Specification
Runway Awareness (Note 1)	**Approaching Runway Advisory** (on ground) Provides flight crew with awareness advisory of a proximate runway edge being approached by aircraft during taxi.	-101	These functions and features are described in Honeywell document 060-4564-001, *Product Description, SmartRunway®/SmartLanding® Functions of the Enhanced Ground Proximity Warning System*
	On Runway Advisory (on ground) Provides flight crew with awareness advisory of which runway aircraft is lined up with.		
	Insufficient Runway Length Advisory (on ground) Provides flight crew with awareness advisory when runway aircraft is lined up with may be insufficient length for takeoff, using operator specified lengths.		
	Insufficient Runway Length Caution (on ground) Provides flight crew with awareness Caution "Caution Short Runway, Short Runway" during takeoff roll, when runway aircraft is using for takeoff may be insufficient length, using operator specified lengths.		
	Extended Holding on Runway Advisory (on ground) Provides flight crew with awareness advisory of extended holding on runway.		
	Taxiway Takeoff Advisory (on ground) Provides flight crew with awareness advisory of excessive taxi speeds or inadvertent take off on a taxiway.		

Related TSO Functional Category	Non-TSO Functions	SW Release Version	Comment
Runway Awareness (Note 1)	**Taxiway Takeoff Caution** (on ground) Provides flight crew with awareness Caution "Caution, On Taxiway, On Taxiway" if excessive taxi speeds or inadvertent take off on a taxiway.	-101	These functions and features are described in Honeywell document 060-4564-001, *Product Description, SmartRunway®/SmartLanding® Functions of the Enhanced Ground Proximity Warning System*
	Distance Remaining During Rejected Takeoff Advisory (on ground) Provides the flight crew with awareness advisory of aircraft position relative to runway end during a Rejected Takeoff.		
	Runway End Advisory (on ground) Provides the flight crew with awareness advisory of aircraft position relative to runway end.		
	Approaching Runway Advisory (in air) Provides the flight crew with awareness advisory of which runway the aircraft is lined-up with.		
	Approaching Short Runway Advisory (in air) Provides the flight crew with awareness advisory when runway aircraft is lined up with may be too short for landing, using operator specified lengths.		
	Approaching Short Runway Caution (in air) Provides the flight crew with awareness Caution "Caution Short Runway, Short Runway "when runway aircraft is lined up with may be too short for landing, using operator specified lengths.		
	Distance Remaining During Landing/Rollout Advisory (in air / on ground) Provides the flight crew with awareness advisory of aircraft position relative to runway end during landing rollout.		
	Taxiway Landing Caution (in air) Provides the flight crew with awareness Caution "Caution Taxiway, Caution Taxiway" if aircraft is not aligned with a runway just before landing.		
Approach Monitor (Note 1)	**Landing Flaps Not Set Advisory** (in air) Provides the flight crew with awareness advisory "Flaps Flaps" if landing flaps not set on approach.	-101	These functions and features are described in Honeywell document 060-4564-001, *Product Description, SmartRunway®/SmartLanding® Functions of the Enhanced Ground Proximity Warning System*
	Excessive Speed Advisory (in air) Provides the flight crew with awareness advisory "Too Fast" if aircraft speed is too fast on approach.		
	Excessive Approach Angle Advisory (in air) Provides the flight crew with awareness advisory "Too High" if aircraft approach angle is too steep.		
	Unstabilized Approach Caution (in air) Provides the flight crew with awareness Caution "Unstable" if aircraft has not been stabilized on approach.		
Takeoff Flap Monitor (Note 1)		-101	These functions and features are described in Honeywell document 060-4564-001, *Product Description, SmartRunway®/SmartLanding® Functions of the Enhanced Ground Proximity Warning System*
	Incorrect Takeoff Flap Caution (on ground) Provides the flight crew with awareness Caution "Flaps Flaps" if an improper flap setting is detected when the aircraft is lined up on a runway in advance of takeoff.		
Long Landing Monitor (Note 1)	**Long Landing Caution** (in air, note 2) Provides the flight crew with awareness Caution of either "Long Landing" or "Deep Landing". The message is aircraft configurable. This function gives the crew awareness of their position during a landing when the aircraft has not touched down in a nominal distance past the approach threshold or before the runway end.	-101	These functions and features are described in Honeywell document 060-4564-001, *Product Description, SmartRunway®/SmartLanding® Functions of the Enhanced Ground Proximity Warning System*
	Long Landing Distance Remaining Advisory (in air, note 2) Provides the flight crew with awareness advisory of the current distance from aircraft to runway end.		

Related TSO Functional Category	Non-TSO Functions	SW Release Version	Comment
Altimeter Monitor (Note 1)	**Above Transition Altitude Monitor** (in air) Provides the flight crew with awareness advisory "Altimeter Setting" if an improper corrected altitude setting is observed while operating above the transition altitude.	-101	These functions and features are described in Honeywell document 060-4564-001, *Product Description, SmartRunway®/SmartLanding® Functions of the Enhanced Ground Proximity Warning System*
	Below Transition Altitude Monitor (in air) Provides the flight crew with awareness advisory "Altimeter Setting" if an improper corrected altitude setting is observed while operating below the transition altitude.		

Notes:

1. These functions are sold under the sales package name of SmartRunway® and/or SmartLanding®, but are referred to in cockpit switches and annunciations as "RAAS" (Runway Awareness and Advisory System).
2. During some high speed approaches, some Long Landing Distance Remaining callouts may be omitted. For a full explanation of this functionality, refer to the *Product Description, SmartRunway®/SmartLanding® Functions of the Enhanced Ground Proximity Warning System.*

5.3.1 SmartRunway® / SmartLanding® Functions

The SmartRunway® and SmartLanding® packages are a group of functions collectively known as the Runway Awareness & Advisory System (RAAS). These functions provide alerts for taxiway takeoff and landing, short runway takeoff and landing, takeoff with incorrect flap configuration, unstabilized approach, long landing, and mis-set altimeter.

These functions have configurable values that can be selected by the operator. The selected values are controlled by a configuration file that is loaded into the EGPWC. The definition and creation of this configuration file is described in the *RCD Selection Guide for the EGPWS Runway Awareness and Advisory System (RAAS)*. The RCD selection guide is listed in the Reference Drawings/Documents table in section 3.0 of this document.

6.0 COMPUTER DESIGN

6.1 Computer Input/Output

The following table summarizes the type and quantity of I/O available with all versions of the EGPWC. A front panel self-test switch, audio jack, and status LEDs are also provided for maintenance and fault isolation. The primary processing is accomplished with a PowerPC SC8378 microprocessor.

Input/Output Type	Quantity
ARINC 429 inputs The inputs can be software programmed for either high or low speed operation.	21
RS-422 inputs Multiplexed with an ARINC 429 receiver.	1
ARINC 429 output channels	2
Picture Bus (ARINC 453/708) output channels	2
2 wire AC/DC analog input channels	4, DC only
Ground activated input discretes	23
+28VDC activated input discretes	8
Program pin inputs used to select configuration and optional features	19
Discrete outputs Drivers for lamps, EFIS/EICAS discrete inputs or external display relay control.	16
Audio outputs An 8-ohm speaker output and a 600-ohm interphone output that is also available at the LRU front panel. The audio volume levels are software controlled.	2
Precision reference output For excitation of external sources, such as AOA vane mounted potentiometers.	1 @ 10 VDC
Rear connector Ethernet interface	3
Front connector USB interface for dataloading	1
Front connector Ethernet interface for ARINC 615A dataloading	1
Front connector Ethernet interface for maintenance troubleshooting and engineering and production testing. This interface allows for access and control of internal EGPWS data and outputs.	1

6.2 Environmental

The environmental qualification for both the 115 VAC and the 28 VDC units are shown below.

Table 5.1-1 – DO-160G Environmental Qualification Form for 115 VAC MKV-A

Nomenclature	MKV-A Enhanced Ground Proximity Warning System (EGPWS)		
Type/Model/Part Number:	115 VAC MKV-A PNs 69000940-[ ] & 6900942-[ ]	TSO NUMBERS:	TSO-C92c, C117a, C151c
Manufactures Specification and/or Other Applicable Specification			
Manufacturer	Honeywell International Inc.		
Address			
Revision & Change Number of DO-160G	Rev New	Date Tested	9/2012 thru 7/2013

CONDITIONS	SECTON	DESCRIPTION OF TESTS CONDUCTED
Temperature and Altitude Low Temperature High Temperature In Flight Loss of Cooling Altitude Decompression Overpressure	4.0 4.5.1 & 4.5.2 4.5.3 & 4.5.4 4.5.5 4.6.1 4.6.2 4.6.3	Equipment tested to Category A2 (modified), F2 Ground Survival Low Temperature -55C, Low Operating Temperature -40C Ground Survival High Temperature +85C, High Operating Temperature +70C In Flight Loss of Cooling Equipment Tested to Category X (Not Applicable) Equipment Tested to Category F2; 55,000 ft Equipment Tested to Category A2; 8,000 ft to 55,000 ft in 15 seconds Equipment Tested to Category A2; Absolute pressure 170kPa (-15,000 ft)
Temperature Variation	5.0	Equipment Tested to Category A; 10C/minute
Humidity	6.0	Equipment Tested to Category A
Operational Shock and Crash Safety -(Impulse and Sustained)	7.0	Equipment Tested to Category B: Performed using a ridged vibration fixture without shock mounts. Crash Safety Sustained performed in centrifuge using a ridged vibration fixture without shock mounts.
Vibration	8.0	Equipment Tested to Category R; Random and Robust Random Curves C & C1. Performed using a ridged vibration fixture without shock mounts.
Explosive Atmosphere	9.0	Equipment Tested to Category E
Water Proofness	10.1	Equipment Tested to Category X (Not Applicable)
Fluids Susceptibility	11.0	Equipment Tested to Category X (Not Applicable)
Sand and Dust	12.0	Equipment Tested to Category D
Fungus	13.0	Equipment Tested to Category F – By Analysis
Salt Fog Test	14.0	Equipment Tested to Category X (Not Applicable)
Magnetic Effect	15.0	Equipment Tested to Category Z
Power Input	16.0	Equipment Tested to Category A(WF)XLPI: A(WF) = AC wide frequency 360 Hz to 800 Hz X = Ac Harmonic Test Not Applicable L = AC Current Modulation Tests P = AC Power Factor Test I = Inrush Current Test
Voltage Spike	17.0	Equipment Tested to Category A
Audio Frequency Susceptibility	18.0	Equipment Tested to Category R(WF)
Induced Signal Susceptibility	19.0	Equipment Tested to Category CW
Radio Frequency Susceptibility	20.0	Equipment Tested to Category R
Radio Frequency Emission	21.0	Equipment Tested to Category M
Lightning Induced Transient Susceptibility	22.0	Equipment Tested to Category A3J3L3 **A3 = Pin Injection Transient Susceptibility**: WF3 @ 600V/24A. WF 4 @ 300V/60A **J3 = Cable Bundle Single and Multiple Stroke Transient Susceptibility**: WF1 @ 300V/600A first stroke and 150V/150A Subsequent strokes. WF3 @ 600V/120A first stroke and 300V/60A Subsequent strokes. **L3 = Cable Bundle Multiple Burst Transient Susceptibility:** WF3 @ 360V/6A @ 1 MHz and 10 MHz
Lightning Direct Effects	23.0	Equipment Tested to Category X (Not Applicable)
Icing	24.0	Equipment Tested to Category X (Not Applicable)
Electrostatic Discharge	25.0	Equipment Tested to Category A
Fire Flammability	26.0	Equipment Tested to Category C – By Analysis

Table 5.1-2 – DO-160G Environmental Qualification Form for 28 VDC MKV-A

Nomenclature	MKV-A Enhanced Ground Proximity Warning System (EGPWS)		
Type/Model/Part Number:	28 VDC MKV-A PN 69000941-[ ]	TSO NUMBERS	TSO-C92c, C117a, C151c
Manufactures Specification and/or Other Applicable Specification			
Manufacturer	Honeywell International Inc.		
Address			
Revision & Change Number of DO-160G	Rev New	Date Tested	9/2012 thru 7/2013

CONDITIONS	SECTON	DESCRIPTION OF TESTS CONDUCTED
Temperature and Altitude Low Temperature High Temperature In Flight Loss of Cooling Altitude Decompression Overpressure	4.0 4.5.1 & 4.5.2 4.5.3 & 4.5.4 4.5.5 4.6.1 4.6.2 4.6.3	Equipment tested to Category F2, F2 Ground Survival Low Temperature -55C, Low Operating Temperature -55C Ground Survival High Temperature +85C, High Operating Temperature +70C In Flight Loss of Cooling Equipment Tested to Category X (Not Applicable) Equipment Tested to Category F2; 55,000 ft Equipment Tested to Category A2; 8,000 ft to 55,000 ft in 15 seconds Equipment Tested to Category A2; Absolute pressure 170kPa (-15,000 ft)
Temperature Variation	5.0	Equipment Tested to Category A; 10C/minute
Humidity	6.0	Equipment Tested to Category A
Operational Shock and Crash Safety -(Impulse and Sustained)	7.0	Equipment Tested to Category B: Performed using a ridged vibration fixture without shock mounts. Crash Safety Sustained performed in centrifuge using a ridged vibration fixture without shock mounts.
Vibration	8.0	Equipment Tested to Category R; Random and Robust Random Curves C & C1. Performed using a ridged vibration fixture without shock mounts.
Explosive Atmosphere	9.0	Equipment Tested to Category E
Water Proofness	10.1	Equipment Tested to Category X (Not Applicable)
Fluids Susceptibility	11.0	Equipment Tested to Category X (Not Applicable)
Sand and Dust	12.0	Equipment Tested to Category D
Fungus	13.0	Equipment Tested to Category F – By Analysis
Salt Fog Test	14.0	Equipment Tested to Category X (Not Applicable)
Magnetic Effect	15.0	Equipment Tested to Category Z
Power Input	16.0	Equipment Tested to Category ZXI: Z = DC Powered Equipment X = DC Current Ripple Test Not Applicable I = DC Inrush Current Test
Voltage Spike	17.0	Equipment Tested to Category A
Audio Frequency Susceptibility	18.0	Equipment Tested to Category Z
Induced Signal Susceptibility	19.0	Equipment Tested to Category CC
Radio Frequency Susceptibility	20.0	Equipment Tested to Category R
Radio Frequency Emission	21.0	Equipment Tested to Category M

CONDITIONS	SECTON	DESCRIPTION OF TESTS CONDUCTED
Lightning Induced Transient Susceptibility	22.0	Equipment Tested to Category A3J3L3 **A3 = Pin Injection Transient Susceptibility**: WF3 @ 600V/24A. WF 4 @ 300V/60A **J3 = Cable Bundle Single and Multiple Stroke Transient Susceptibility**: WF1 @ 300V/600A first stroke and 150V/150A Subsequent strokes. WF3 @ 600V/120A first stroke and 300V/60A Subsequent strokes. **L3 = Cable Bundle Multiple Burst Transient Susceptibility:** WF3 @ 360V/6A @ 1 MHz and 10 MHz
Lightning Direct Effects	23.0	Equipment Tested to Category X (Not Applicable)
Icing	24.0	Equipment Tested to Category X (Not Applicable)
Electrostatic Discharge	25.0	Equipment Tested to Category A
Fire Flammability	26.0	Equipment Tested to Category C – By Analysis

6.3 Reliability

6.3.1 Scheduled Maintenance

No scheduled maintenance is required.

6.3.2 Calibration

No calibration is required.

6.3.3 MTBF/MTBUR

MIL-HDBK-217 Plus was used to estimate EGPWC MTBF and MTBUR values for the MKV-A beginning three years from the Initial Production Delivery (IPD) date.

UNIT	MTBF (operating hours)	MTBUR (operating hours)	IPD	Comments
MKV-A EGPWS 6900094x-xxx	25,000	21,250	2014	Estimates completed prior to initial product delivery.

The EGPWC Failure Modes and Effects Analysis (FMEA) was developed using SAE ARP5580 (Recommended Failure Modes and Effects Analysis (FMEA) Practices for Non-Automobile Applications) and in some cases MIL-STD-1629 as guidelines. The Honeywell part number for the EGPWC FMEA document is shown below.

The FMEA employs failure estimates based on MIL-HDBK-217 Plus.

UNIT	DOCUMENT #	COMMENTS
MKV-A EGPWS 6900094x-xxx	SSA69000940-301	69000940-xxx = 115 VAC Unit 69000941-xxx = 28 VDC Unit 69000942-xxx = 115 VAC Unit

6.4 EGPWC Power Requirements

Input power requirements for both 115 VAC and 28 VDC versions of the MKV EGPWC are provided in the table below.

End Item Part Number	69000940-xxx 69000942-xxx	69000941-xxx
EGPWC Input Power Type	115 VAC/400 Hz	28 VDC
EGPWC Input Power Requirement		
With no warning	21 Watts	20 Watts**
With warning (over 8 speaker)	24 Watts	23 Watts**
With heater blanket on*	NA	78.5 Watts, max**
Power Maximum	25.95 VA	N/A
Power Factor	0.925	N/A
Recommended EGPWC Power Control Device	2 Amp Delayed Action Circuit Breaker	5 Amp Delayed Action Circuit Breaker

* The heater blanket (69000941-xxx only) turns on at temperatures ≤ -40° C and turns off at temperatures ≥ -20° C.
** Power numbers are for input at 28.0 VDC.

6.4.1 System Response to Power Interrupts

On application of power to the EGPWC, the computer will perform a power up BIT test to assure proper system performance prior to initiation of normal operation. The time delays before commencing normal operation will be as defined in the tables below. The system response to power interrupts will be as follows:

Power interrupt duration	System Response	Maximum Delay to Normal Operation
115 VAC Powered EGPWC (P/Ns 69000940-xxx and 69000942-xxx)		
T < 200 msec.	No effect	Not applicable
T ≥ 200 msec.	Cold start	20 seconds Max
28 VDC Powered EGPWC (P/Ns 69000941-xxx)		
T < 60 msec.	No effect	Not applicable
T ≥ 60 msec.	Cold start	20 seconds Max

6.5 Mechanical

6.5.1 Packaging

The EGPWC is packaged in a 2 MCU ARINC 600-6 form factor chassis. Refer to the outline drawing referenced in section 3. The part number appearing on the front panel identification plate is 69000940-xxx (MKV-A EGPWS, 115 VAC); 69000941-xxx (MKV-A EGPWS, 28 VDC); or 69000942-xxx (MKV-A EGPWS, 115 VAC, Alternate PN).

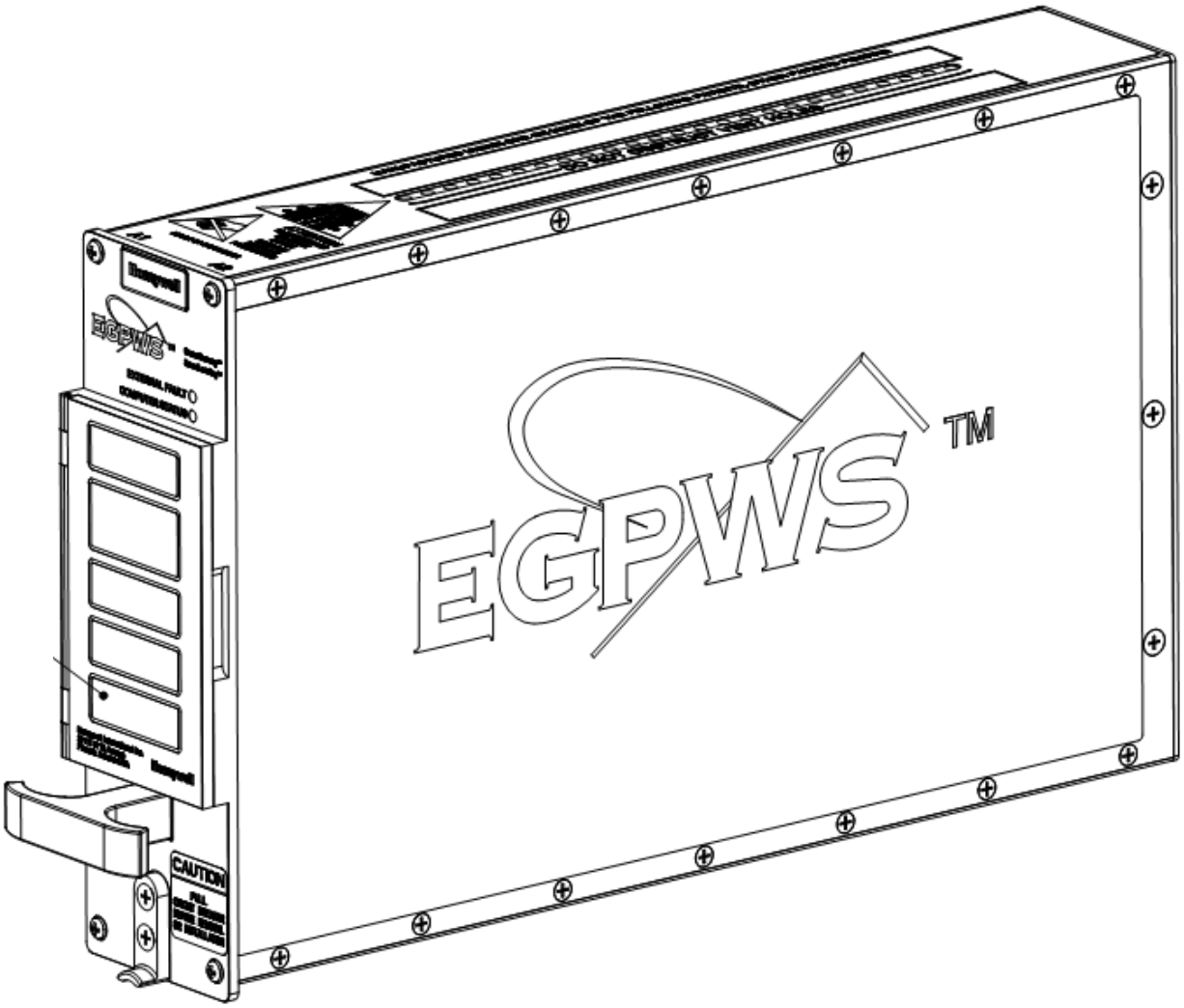


Figure 6.5.1-1: MKV-A EGPWC

6.5.2 Outline

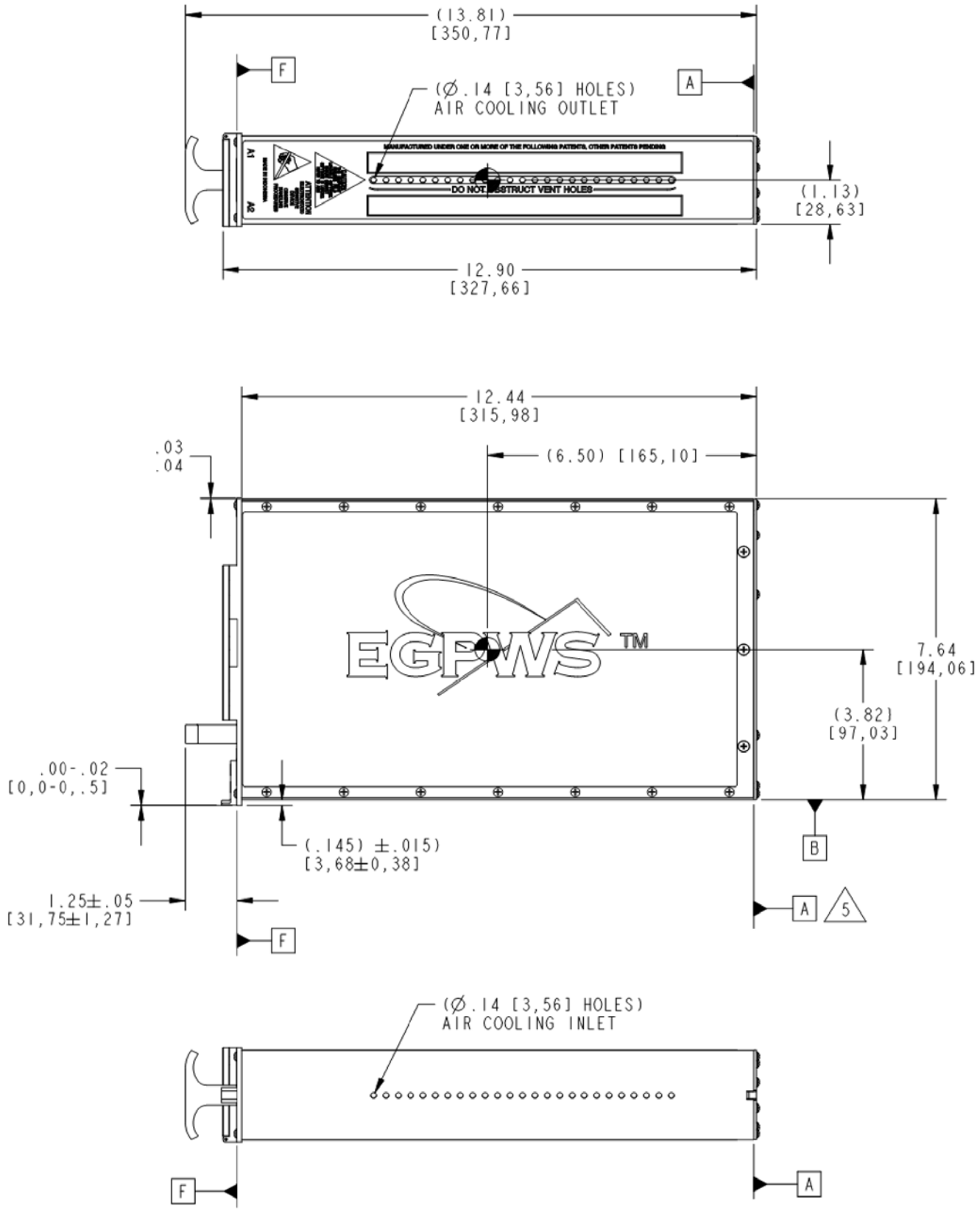
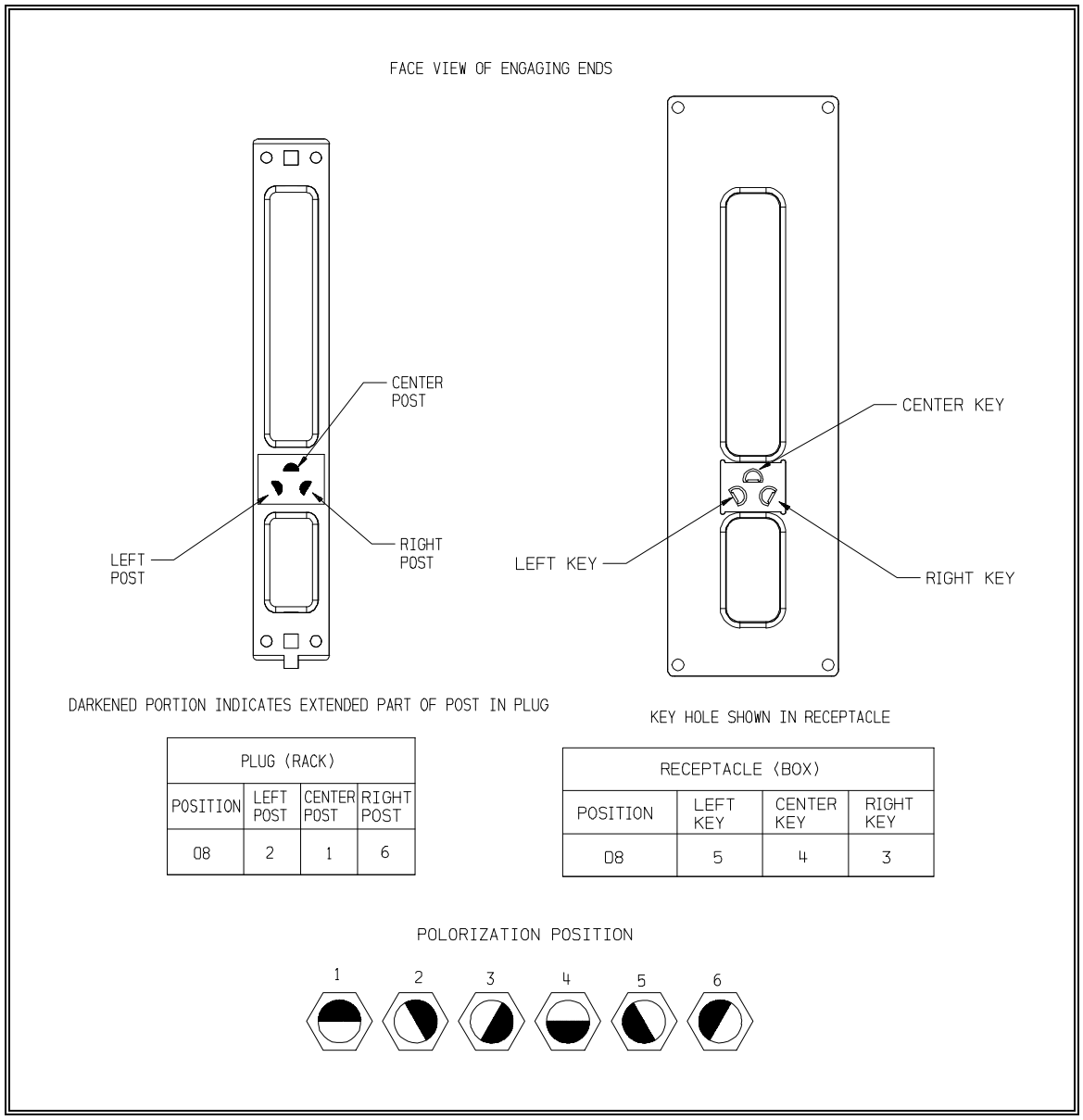


Figure 6.5.2-1: MKV-A Outline

6.5.3 Rear Connectors

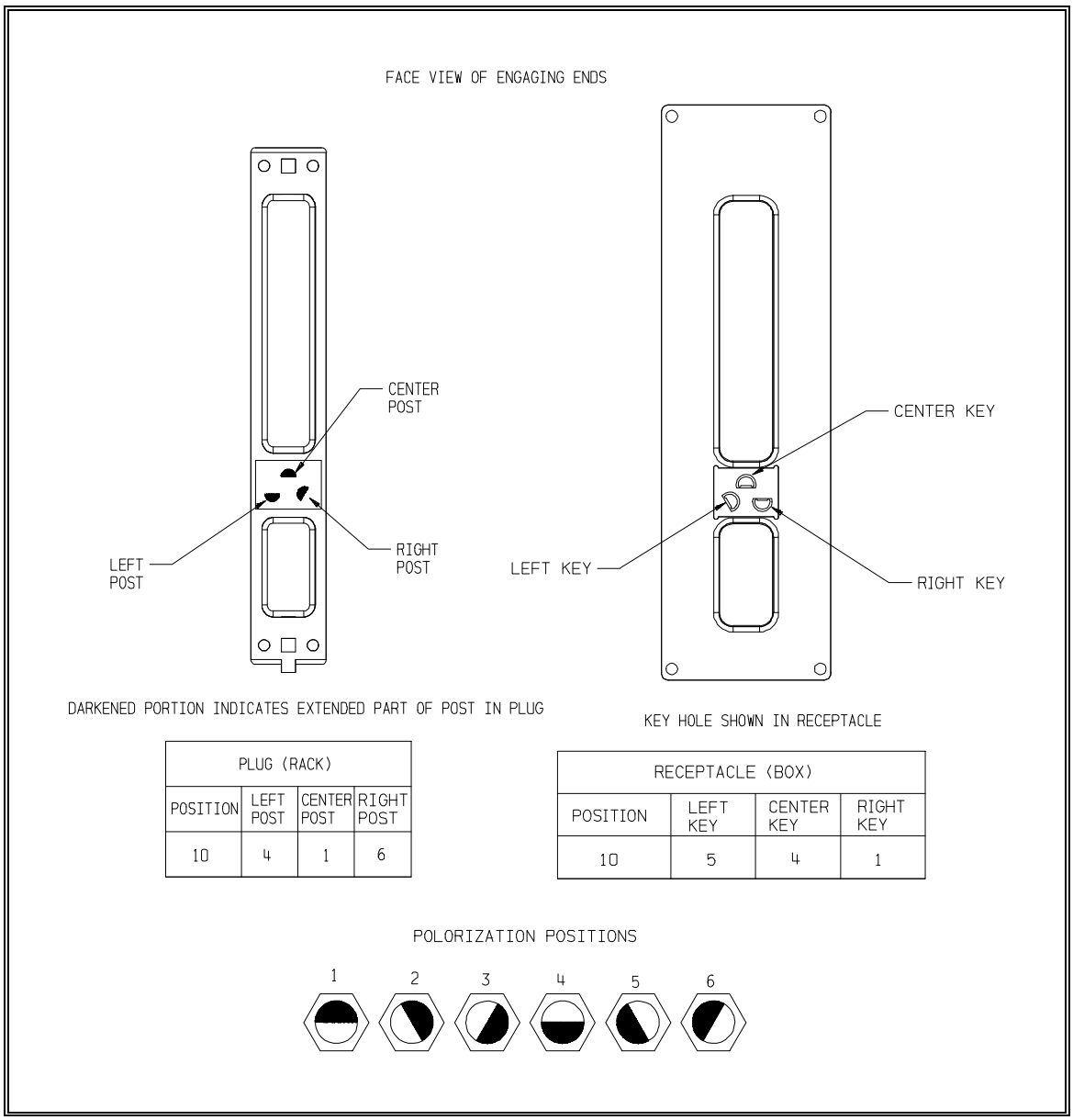
The rear connector is divided into three shells. The top and middle shells contain all interface signals. Power interface is in the bottom shell, isolated from interface signals. Connector index pin coding is orientation “08” for 115V, reference figure 6.5.3-1, and orientation “10” for 28V, reference figure 6.5.3-2, in accordance with ARINC 723-1 recommendations for the GPWS. Part numbers for the rear connectors are listed in section 6.5.4.



PLUG (RACK)			
POSITION	LEFT POST	CENTER POST	RIGHT POST
08	2	1	6

RECEPTACLE (BOX)			
POSITION	LEFT KEY	CENTER KEY	RIGHT KEY
08	5	4	3

Figure 6.5.3-1: Rear Connector Keying for the 115V MKV-A EGPWC



PLUG (RACK)			
POSITION	LEFT POST	CENTER POST	RIGHT POST
10	4	1	6

RECEPTACLE (BOX)			
POSITION	LEFT KEY	CENTER KEY	RIGHT KEY
10	5	4	1

Figure 6.5.3-2: Rear Connector Keying for the 28V MKV-A EGPWC

6.5.4 Connector, Shells & Contacts

ITEM	QTY	Vendor & Part No.			
		Honeywell	AMP	Cannon	Souriau
EGPWS (115V) Rear Connector ARINC 600 Size 1	1	440-0497-002	NIC66F11A08AA1	BKAD1-125-30008-F0	S611-MG-05W2-P0008-L
EGPWS (28V) Rear Connector ARINC 600 Size 1	1	440-0497-005	NIC66F11A10AA1	BKAD1-125-30010-F0	S611-MG-05W2-P0010-L
Lower Plug Power Pins	2	404-4127-002	208270-2	031-1303-000	8660-249
Insertion/Extraction Tool		-	91066-3	-	-
Crimp Tool		M22520/1-01 with positioned M22520/1-02 (AMP Coaxicon)			
Lower Plug Ground Pin	1	404-4127-003	208273-2	031-1308-000	8660-250
Insertion/Extraction Tool		--	445147-1	-	-
Crimp Tool		M22520/1-01 with positioned M22520/1-11 (AMP Coaxicon)			
Top and Middle Plug I/O Pins	120	404-4127-004	208262-3	030-2259-000	8660-202
Insertion/Extraction Tool		-	91066-1	-	-
Crimp Tool		M22520/2-01 with positioned M22520/2-23 (AMP Coaxicon)			

6.5.5 Weight

The weight of the EGPWC, tray and connector is listed in the table below.

Part No.	Weight
EGPWC 69000940	6.00 lbs
EGPWC 69000941	6.25 lbs
EGPWC 69000942	6.00 lbs
Tray 600-4697-001	0.85 lbs
Connector	0.45 lbs

6.5.6 Aircraft Mounting

Aircraft mounting is per ARINC 600-6. Vibration isolation or shock mounting is not required. The mounting tray can be ordered from Honeywell or other suppliers.

The table below lists supplier information.

Supplier	Part No.	Contact Info.
Honeywell	600-4697-001	http://www.honeywell.com/sites/aero/Avionics_Services1.htm
AEI		http://www.aeisinc.com/ARINC+Standard+Mounting+Trays
Barry Controls		http://www.barrycontrols.com/products/product.cfm?cid=13
Carlisle		http://www.carlisleit.com/product/arinc-600-trays
EMTEQ		http://www.emteq.com/equipment-mounting-trays.php

Cooling shall be per ARINC 600-6 and ARINC 404A convection cooling. No forced air cooling is required for specified system performance over the environmental conditions specified in section 6.2 of this document.

If cooling is provided, then 2.0 CFM is preferred. Per ARINC 600-6 the resultant pressure differential would be 5 ±3 mm of H_2O.

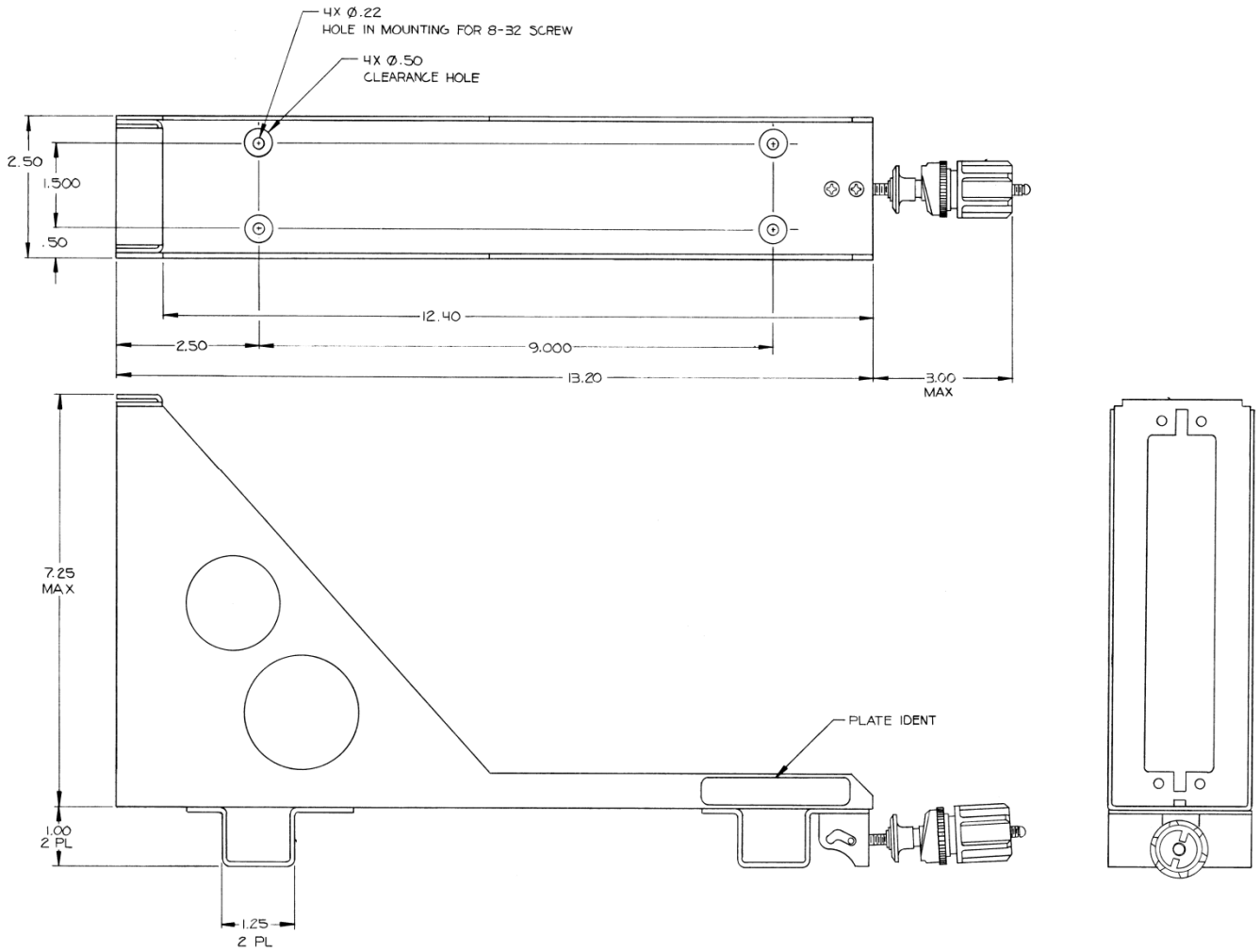


Figure 6.5.6-1: Mounting Tray Outline

7.0 Software Design

The software criticality has been determined based on the overall functional hazard classification as indicated in the Functional Hazard Assessment (FHA) for the MKV-A Enhanced Ground Proximity Warning System (EGPWS), SSA69000940-100.

Based on the functional hazard assessment, the most severe failure category is classified as *Major*. In support of the most severe system failure category the CSCIs for the EGPWS are being developed to DO-178B Level C and D standards. Maintenance functions like CFDS/CMC, Flight History and the Keyboard interface will be DO-178B Level D. A DO-178B Level E network stack, debugger, status monitor, telnet server, and FTP server will be included to support debugging, diagnostics, and test, but these components will be deactivated in revenue flight. The basis for EGPWS certification are DO-161A, DO-178B, DO-200A, TSO-C92c, TSO-C117a, TSO-C151c, AC 25-11A, AC 25-12, AC 25-23, AC 25.1309-1A, AC 120-40, AC 120-41, 14 CFR 25.1301 and 25.1309.

Table 7-1, Software Level Criticalities, lists the components, functions, failure category, and associated software level for the EGPWS Application CSCI.

Table 7-1 Software Level Criticalities

Component	Function	Failure Category	Software Level
Shared Functions	Utilities & Voice Data Operating System File System Current Value Table Configuration Data Non-Volatile Memory	Major	DO-178B Level C
Monitoring Functions	Task Monitor Built In Test Self-Test controller and Level 1 (go/no-go)	Major	DO-178B Level C
I/O Functions	Input Processing Output Processing	Major	DO-178B Level C
Alerting Functions	Ground Proximity Warning Advisories (Mode 6, RAAS) Windshear	Major	DO-178B Level C
Network-Based Data Loading	ARINC 615 ARINC 615A	Minor	DO-178B Level D*
Maintenance Functions	Self-Test Levels 2 through 6 CMC CFDS Flight History Keyboard Monitor	Minor	DO-178B Level D
Debug/Diagnostic (Deos™ Supplied)	Network Stack Debugger Status Monitor Telnet Server FTP Server	No Safety Effect**	DO-178B Level E

*There is a small portion of the ARINC 615/615A dataloader that responds to basic queries and the initial dataload request. There is another small portion that verifies the load results. These portions are DO-178B Level C with a failure category of Major.
**Debug/Diagnostic component is deactivated in revenue flight.

8.0 Installing a MKV-A in an Aircraft Previously Fitted With a MK V EGPWS

The MKV-A EGPWC is designed as a replacement for the MK V EGPWC. The MKV-A EGPWC retains all previous functions of the MK V EGPWC while addressing issues with out-of-production parts; and limitations with memory, processor throughput, and input/output interfaces. It also provides updated interfaces for software uploading and downloading which include Ethernet and USB memory stick data loading capability.

The MKV-A EGPWC is a direct replacement for the previous MK V EGPWC with part numbers 965-0976-0XX-XXX-XXX, 965-1676-XXX (Airbus), and 965-1690-XXX (Boeing). The table below shows the part numbers for the initial release of the MKV-A and the MK V model that it replaces.

MKV-A to existing MK V part number mapping

New MKV-A EGPWC Part Number	Characteristics	Replaces MK V EGPWC Part Numbers	Characteristics
69000940-XXX	115 VAC	965-0976-003-XXX-XXX	115 VAC; used on multiple aircraft
		965-1690-0XX	115 VAC; used on B737 and B747-8
69000941-XXX	28 VDC	965-0976-040-XXX-XXX	28 VDC; used on multiple aircraft
69000942-XXX	115 VAC	965-1676-0XX	115 VAC; used on A320/330/340 aircraft

The EGPWS has a number of selectable options that are configured as part of the installation design. There are two different installation methods to control the configuration options on the MKV-A. The first method is to control the configuration options through program pin strapping. The second method for controlling the configuration options is through the use of an Aircraft Personality Database (APD) or Option Selection Software (OSS).

For details on selection of the aircraft type and program pin wiring, refer to Appendix D in the ICD, document no. SYS69000940-700.

8.1 Retaining the Pin Program Strapping to Define Configuration Options

If a MKV-A EGPWS is being installed as a replacement for a MK V EGPWS and there are no changes that are being made to any of the configuration option selections, then the MKV-A can be installed with no wiring changes. The MK V can be removed and the MKV-A simply plugged into the existing installation.

8.2 Using the APD or OSS to Define Configuration Options

The Aircraft Personality Database (APD) and Option Selection Software (OSS) are configuration files that are loaded into the unit to control the selection and activation of the selectable options. Four program pins are used to define the aircraft type while the APD/OSS controls the selectable options. The APD definition is contained in Appendix B-1 in the ICD. The OSS definition is contained in Appendix B-2 in the ICD.

A User's Manual for the APD generation tool exists and is referenced in Section 3.0.

Wiring changes to an existing MK V installation are required if an APD or OSS is used. When using an APD or OSS, all existing program pin wires must be disconnected. The program pins that select the aircraft type must be strapped to the appropriate connections. These three program pins are TP-10A (PPCNF1), TP-10B (PPCNF2), and TP-10C (PPCNF3). MP-4D (PPCNF4) is currently a spare but this pin must be strapped to chassis ground to ensure that a program pin open wire fault is not reported. See ICD Appendix D-1 for the program pin strapping.

All existing wires that are connected to MP-3A must be disconnected and re-connected to chassis ground. In the legacy MK V installation, MP-3A provides the Program Pin Common connection, which was connected to aircraft ground. In the MKV-A, MP-3A is used as a discrete monitor output when an APD or OSS is used.

9.0 Feature and Option Selection

The MKV-A EGPWS provides a set of default features that are defined by Aircraft Type. The functionality of many of these features may be tailored to suit customer preferences by appropriate program pin strapping, or by defining the option selection via the APD.

Refer to the *Product Specification for the MKV-A EGPWS* for more information on the functionality, features, and options. Refer to the *Interface Control Document for the MKV-A EGPWS* for configuration details of each aircraft type.

10.0 Cockpit Annunciators

10.1.1 Lamp Drivers

The EGPWC supports two types of Ground/Open discrete outputs used to signal various discrete conditions. Monitor Discrete outputs are used to signal failure conditions for the computer or the system. Other Lamp Driver outputs are used to signal the warning or mode control status of the EGPW system. Short term current limiting protection is provided on all drivers for output shorting conditions. The Monitor Discretes are biased ON (via lamp power) when the EGPWC is not powered while installed.

Lamp Driver and Monitor Discrete Output Characteristics

Max. Open Circuit Voltage	30 VDC
Current Limit	1 Amp
Potential across "Closed" switch	1 VDC Max.

The ground going discrete may be wired together with diode isolation to produce the "OR" function for the active low state of these signals. These outputs can also be used as discrete drivers for other devices.

All alert/warning lamp outputs are normally a steady state switch to ground. The lamps can be individually programmed to flash as a function of Aircraft Type only (see Interface Control Document). The flashing outputs operate at a nominal 70 cycles per minute and 50% duty cycle.

10.1.2 Lamp Format Type 1 and 2

Two Lamp Formats are defined as a function of the aircraft type and are modifiable. The Lamp Format Type is defined in the *Configuration Data* table and referenced in the *Output Discrete Definitions* table of each aircraft type in the Interface Control Document.

For Lamp Format Type "1" configurations, only Mode 5 "Below Glideslope" message will activate the alert lamp output (amber). All other messages (except Windshear) will activate the warning lamp output (red).

For Lamp Format Type "2" configurations, only messages containing the word "Pull-Up" will activate the warning lamp output (red). All other messages (except Windshear) will activate the alert lamp output (amber).

Note the Mode 6 does not activate any lamp outputs, only voices.

10.1.3 Lamp Format Reversal

For those Aircraft Types defined as using Lamp Format Type "1" in the Interface Control Document *Configuration Data* table (dedicated Below Glideslope annunciation), the Lamp Format Type "2" can be optionally selected via PPCNF12 *Lamp Format Reversal*. This option changes the Below Glideslope annunciation (both the Lamp Driver Discrete Output and the ARINC 429 label 274 bit 12) to be activated for all non Pull-Up annunciations and the warning Discrete Output (both the Lamp Driver Discrete Output and the ARINC 429 label 274 bit 13) to be activated for "Pull-Up" annunciations only.

In addition, if the Terrain (or Obstacle) caution discrete outputs are defined in the Aircraft Type of the Interface Control Document to activate the GPWC warning lamp this option will move those annunciations to the GPWC alert lamp discrete output. "Lamp Format 2 Selected" will be reported during the Level 3 Self-Test and in the Present Status output.

10.1.4 Glideslope Cancel Discrete Output

Use of the Alternate Glideslope Cancel feature requires that there be a cockpit annunciation that the cancel is in effect. This can be done using the Glideslope Cancel Discrete Output of the EGPWC. The Glideslope Cancel Discrete Output activates when the Mode 5 "Glideslope" message has been cancelled by cockpit switch.

10.1.5 Windshear Lamp Driver Discrete Outputs

The Mode 7 Reactive Windshear detection warning (red), caution (amber) and INOP Lamp Driver discrete outputs are defined by the Interface Control Document Aircraft Type *Output Discrete Definitions* table.

10.1.6 Terrain/Obstacle Lamp Driver Discrete Outputs

The Terrain / Obstacle warning (red), caution (amber), inhibit/override and INOP/Not Available Lamp Driver discrete outputs are defined by the Interface Control Document Aircraft Type *Output Discrete Definitions* table.

10.1.7 Terrain Display Switching and Terrain Displayable Discrete Outputs

The EGPWC produces two discrete outputs for controlling the terrain display. They can be used either to control picture bus switching relay(s) or connected directly to the symbol generators.

For some installations, the EGPWC produces two 'Terrain Displayable' discrete outputs for controlling the display of the Terrain Mode annunciation lamps. One discrete is used for the Captain's terrain display mode annunciation and one for the F.O.'s terrain display mode annunciation. For each pilots' side, if the EFIS is in a mode which will support Terrain display, the Terrain display function is valid, and the Terrain display has been selected (either via manual selection or auto pop-up when applicable), then the discrete will be set active so that the Terrain Mode annunciation lamp is illuminated.

For some installations the EGPWC produces two 'Displayable' discrete outputs for controlling display mode annunciation lamps. One discrete is used for the Captain's display mode annunciation and one for the F.O.'s display mode annunciation. Each output is routed through the picture bus switching relay to drive either TERR mode annunciation if terrain is displayed, or WXR mode annunciation if the WXR R/T is on (displayed or not).

10.1.8 RAAS Monitor Discrete Output

For some installations a dedicated discrete output is provided as a RAAS monitor, which is activated when RAAS is inoperative.

10.1.9 Indicator/Control Format Table

Recommended indicator nomenclature, color, and location is listed in the table below.

Indicator/Control		Color	Recommended Location	Function
<<<<< Required Indicators and Controls >>>>>				
Lamp Format Type 1	2	Lamp Format is defined by the Aircraft Type Configuration Data table		
GPWS	**PULL UP**	RED	In Pilot Primary Field of View	GPWS or PULL UP warning alerts including Terrain & Obstacle warnings
BELOW G/S	**GPWS**	AMBER	In Pilot Primary Field of View	BELOW G/S or GPWS/RAAS caution alerts including Terrain & Obstacle cautions

GPWS FAIL or **GPWS INOP**	AMBER	With other system fail indicators	Indicates that a function in the GPWS system is inoperative
TERR INOP	AMBER	With other system fail indicators	Indicates that TAD and TCF functions are inoperative or not available
TERR OFF or **TERR OVRD** or **TERR INHIBIT**	WHITE or BLUE	Within reach of both pilots	Indicates that TAD and TCF functions have been manually turned off. Lamp illuminated when TAD/TCF inhibited
GPWS P/TEST (Note 1)	N/A	Within reach of both pilots	EGPWS press to Self-Test
G/S P/CANCEL (Note 2)	N/A	Within reach of both pilots	EGPWS BELOW G/S press to Cancel

Indicator/Control	Color	Recommended Location	Function
<<<<< Optional Indicators and Controls >>>>>			
WINDSHEAR	RED	In Pilot Point of View	Windshear warning
WINDSHEAR	AMBER	In Pilot Point of View	Windshear caution
WINDSHEAR FAIL or **WINDSHEAR INOP**	AMBER	With other system fail indicators	Indicates that Reactive Windshear detection is inoperative
G/S CANCELED	WHITE, BLUE or AMBER	Within reach of both pilots	On when G/S alerts are manually canceled. Typically only used with **Alternate G/S Cancel** selection
FLAP OVERRIDE	WHITE	Within reach of both pilots, near Flap handle	Inhibits GPWS Mode 4B “Too Low Flaps” alert (pilot may manually reset)
GPWS INHIBIT	WHITE	Within reach of both pilots	Silences GPWS audio
ALTITUDE CALLOUTS	WHITE	Within reach of both pilots	Silences radio altitude callouts audio
ALTITUDE CALLOUTS	AMBER	In same assembly as above Inhibit or with other system fail indicators	Indicates Radio Altitude Callouts functions are inoperative
TERR	WHITE, BLUE or GREEN	Within reach of both pilots, near each terrain display	Indicates Terrain Display selected ON, momentary press to select/deselect. Use one for each (pilots) terrain display
RANGE knob	N/A	On WX Control panel or EFIS Control panel	Controls range of Terrain display
RAAS INOP or **RAAS FAIL**	AMBER	With other system fail indicators	Indicates Runway Awareness function(s) are inoperative or not available
RAAS INHIBIT or **RAAS OVRD**	WHITE	Within reach of both pilots	Silences Runway Awareness callouts audio
Note: 1 Typically, GPWS Press to Test is located on the red PULL UP or GPWS lamp assembly. 2 Typically, G/S Press to Cancel is located in the amber GPWS or BELOW G/S lamp assembly.			

10.1.10 Indicator/Control Suppliers

Listed below are some sources of indicators and/or control panels for the EGPWS.

Supplier	Contact Info.
Korry Electronics	http://www.esterline.com/controlsystems/KORRY/KORRYHome/tabid/2394/Default.aspx/
Vivisun	http://www.vivisun.com/products/
Eaton / Staco	http://www.flamecorp.com/Staco.php
Mid-Continent	http://www.mcico.com/TAWS-CNBC1F25D2AAA4.html?MN=9402D0065F24
Ameri-King	http://ameri-king.com/
Northern Airborne	http://www.northernairborne.com/pdfs/install_Ops/SM53_RGT/Install_Ops/804-0400.pdf

11.0 Electrical Interface

11.1 Output Discrete Diode Isolation

It is recommended that output discretes that are connected as program pin terminations be pulled up to at least 12 VDC or must be diode isolated. See Figure A-3 for an example of the program pin diode isolation wiring.

11.2 Terrain Display Interface

Retrofit Terrain Display wiring must meet the Weather Radar display manufacturer's requirements, including termination. ARINC 429 control bus wiring must be twisted shielded pair cable.

ARINC 453 picture bus wiring must meet the following requirements:

- Cable length must be 300 feet (91.4 meters) or less
- Wire to Wire capacitance must not exceed 10 nF total
- Shielded twisted pair with not less than one twist per inch
- Impedance of 70-78 ohms +/- 10% at 1 MHz
- Recommended sources: PIC Wire PN D620224; EMTEQ PN D07802-100

11.2.1 Switching Relays

In some installations, a relay is used to switch the display input between the weather radar input and the EGPWS Terrain input.

Examples of the terrain display switching relay implementation are shown in Figure A-2

11.3 Analog Interfaces

The analog ports are shown in Figure A-4. Analog ports 1 and 2 have an input impedance of 90K ohms. Analog ports 3 and 4 are considered high impedance ports and have a nominal input impedance of 2.41M ohms.

11.4 Cabling and Grounding

Wire size and lengths of power return, chassis ground, and shield pigtails are shown in Figure A-5. This diagram is an example. Pertinent aircraft manuals and wiring diagrams should be followed.

12.0 External Position Source

The MKV-A requires external sources to provide horizontal position, vertical position, velocity, and vertical rate information.

12.1 Horizontal Position Source

External GPS interfaced to the EGPWS must meet the performance requirements of TSO-C129a or any revision of TSO-C145, TSO-C146, or TSO-C196.

Aircraft operating under 14 CFR §121 may be configured to operate solely on a non-GNSS position source.

12.2 Vertical Position Source

Vertical position may come from a barometric source such as an altimeter or air data computer or from a geometric source such as GNSS. The MKV-A also requires a radio altimeter vertical position source.

External vertical position sources must meet minimum performance requirements of the applicable document as listed below:

- Barometric Altitude: TSO-C10b or TSO-C106
- Vertical Velocity: TSO-C8
- Radio altitude: TSO-C87 or ETSO-2C87 or DO-155
- GNSS: Minimum vertical accuracy meeting DO-229D section 2.2.3.3.4

13.0 Installation Checkout

13.1 Maintenance Philosophy

Installation checkout typically consists of performing a ground test of the EGPWS. The ground test consists of performing Self Test Levels 1, 2, 3, and 6 to verify proper installation and function of cockpit switches and lamps. The Line Maintenance Manual (LMM) referenced in Section 3.0 provides a resource for troubleshooting in-service and new installations of EGPWS. The LMM also provides details on other routine EGPWS tasks such as database loading.

13.2 Ground Test

A system checkout to verify correct installation should be performed. A generic ground test procedure is included in Appendix B of this document. This sample procedure should be tailored to the installation being tested in order to verify the aircraft specific interfaces.

Further examples of ground tests are available from Honeywell via the EGPWS website. To obtain a copy of a sample Ground Test Procedure, please visit www.egpws.com, select the Support tab, then Installation Information, then Ground & Flight Test Procedures sub-page.

Also refer to the Line Maintenance Manual for more information on line maintenance operations and troubleshooting.

13.3 Computer Status LED

A COMPUTER STATUS LED is located on the front panel of the LRU. During the power up sequence the LED should be ignored. Once the LRU has completed its power up initialization (approximately 20 seconds after application of power) the LED will remain illuminated and the status will be indicated by the LED color as described in the table below. More information on the LRU Status LEDs can be found in the Line Maintenance Manual.

COMPUTER STATUS LED	
COLOR	**INDICATION**
Not illuminated	Not powered
Green	Powered, No faults
Red	Powered, Internal fault

14.0 Installation Limitations

14.1 TSO-C92c Installation Note

TSO-C92c, e., requires the manufacturer to provide the following note to each person receiving for use one or more articles manufactured under this TSO:

> "The conditions and tests required for TSO approval of this article are minimum performance standards. It is the responsibility of those desiring to install this article on or within a specific type or class of aircraft to determine that the aircraft installation conditions are within the TSO standards. The article may be installed only if installation of the article is approved by the Administrator."

14.2 TSO-C117a Installation Note

TSO-C117a, i., requires the manufacturer to provide the following note to each person receiving for use one or more articles manufactured under this TSO:

> "The conditions and tests required for TSO approval of this article are minimum performance standards. It is the responsibility of those desiring to install this article either on or within a specific type of class of aircraft to determine that the aircraft installation conditions are within the TSO standards. The article may be installed only if further evaluation by the applicant documents an acceptable installation and is approved by the Administrator."

14.2.1 TSO-C117a Incomplete TSO Article

TSO-C117a provides minimum performance standards for airborne windshear warning and escape guidance systems for transport category aircraft. The MKV-A EGPWS provides the airborne windshear warning function but does not provide escape guidance, and therefore only provides part of the functionality specified in the TSO.

An Airborne Windshear Warning System is defined in TSO-C117a, paragraph a.(4)(i), while an Airborne Windshear Escape Guidance System is defined in paragraph a.(4)(iv). In order to provide the complete functionality of both a windshear warning and an escape guidance system, a separate guidance system must be installed in addition to the windshear warning function that is provided by the MKV-A EGPWS. The windshear warning function provided by the MKV-A operates independently of any escape guidance function and/or auto recovery system.

The windshear warning function is described in the *Product Specification for the MKV-A Enhanced Ground Proximity Warning System*, document no. PDS69000940-000. Details of the windshear alerting function and the system performance is described in section 6.5 of the product specification document.

14.2.2 Boeing Windshear Caution (Pre-Alert)

The Boeing Windshear algorithm is considered an alternate implementation of the windshear function and is limited to specific aircraft types. The Boeing Windshear algorithm includes both a warning function and an optional caution (pre-alert) function. The Boeing Windshear caution (pre-alert) function is not supported and is not available in the MKV-A EGPWS on any aircraft types, including those that use the Boeing Windshear Warning algorithm.

14.3 TSO-C151c Installation Note

Per TSO-C151c, 5.a.(3), the following statement applies to installation of the equipment covered by this document:

> "This article meets the minimum performance and quality control standards required by a technical standard order (TSO). Installation of this article requires separate approval."

14.4 KCPB Installation Note

For installations using the KCPB display interface it should be noted that:

- The Check Altitude function is not supported by the MKV-A EGPWS.
- When a Vertical Situational Display (VSD) is provided simultaneously with the standard horizontal display, the Airplane Flight Manual Supplement (AFMS) should contain the following statement; "During a terrain warning, the horizontal and vertical terrain display may not show the same color for threatening terrain, and the horizontal display is to be considered the primary source of terrain threat information." An example of a KCPB display interface capable of VSD is the Honeywell Enhanced GNS-XLS.

More details of the KCPB display interface are provided in the EGPWS Interface Methodology document.

14.5 GPS Installation Note

Honeywell does not recommend activation of the Altimeter Monitor – Below Transition Altitude function in EGPWS connected to Honeywell PXpress-based GPS engines (KLN-94, GNS-XES, GNS-XLS) due to observed prolonged instances of altitude aiding. The Altimeter Monitor – Below Transition Altitude is inoperative when the GPS source is in altitude aiding mode, during which time the crew will observe activation of an installed RAAS INOP annunciation.

14.6 Mode 1 GPWS Alert Envelope (Raise lower cutoff from 10 feet to 130 feet) Installation Note

The Mode 1 steep approach mode described in TSO deviations section 5.1.2 has been approved for the A320 family of aircrafts only.

14.7 Low Airspeed Monitor on 69000940-101 and 69000942-151 Installation Note

A software defect exists in the Low Airspeed alerting logic in the 69000940-101 and 69000942-151. In the case when the Low Airspeed Alert Threshold is ramping upward and moves above Computed Airspeed, the Low Airspeed alert is missed. The Low Airspeed Monitor should never be activated on the 69000942-151. The MKV-A 69000940-1xx is part of the standard production installation for Boeing 737 Aircraft. The Low Airspeed Monitor is only enabled on Boeing 737 aircraft which should not have the 69000942-151 installed. The Low Airspeed software defect is resolved in Application Software version 02 and later.

14.8 Terrain Awareness Caution and Warning visual alerts during Self Test Installation Note

For installations that do not have the Terrain Caution lamp configured, which are currently limited to Boeing 737 aircraft types, when the self test is executed the Terrain Warning and Terrain Caution 429 output bits are not being set, and therefore are not being displayed on the ND. This issue is specific to the Terrain Awareness Caution and Warning visual alerts during Self Test and is limited to the following Boeing aircraft types: 737-600 Integrated, 737-700 Integrated, 737-800 Integrated, 737-700IGW Integrated, 737-NG Integrated, and 737-800 Integrated MMA (P-8A).

Appendix A: Sample Wiring Diagrams

The figures that are included in this section are examples of EGPWS interface wiring. Pin connections for each specific aircraft type are listed in Appendix F of the ICD.

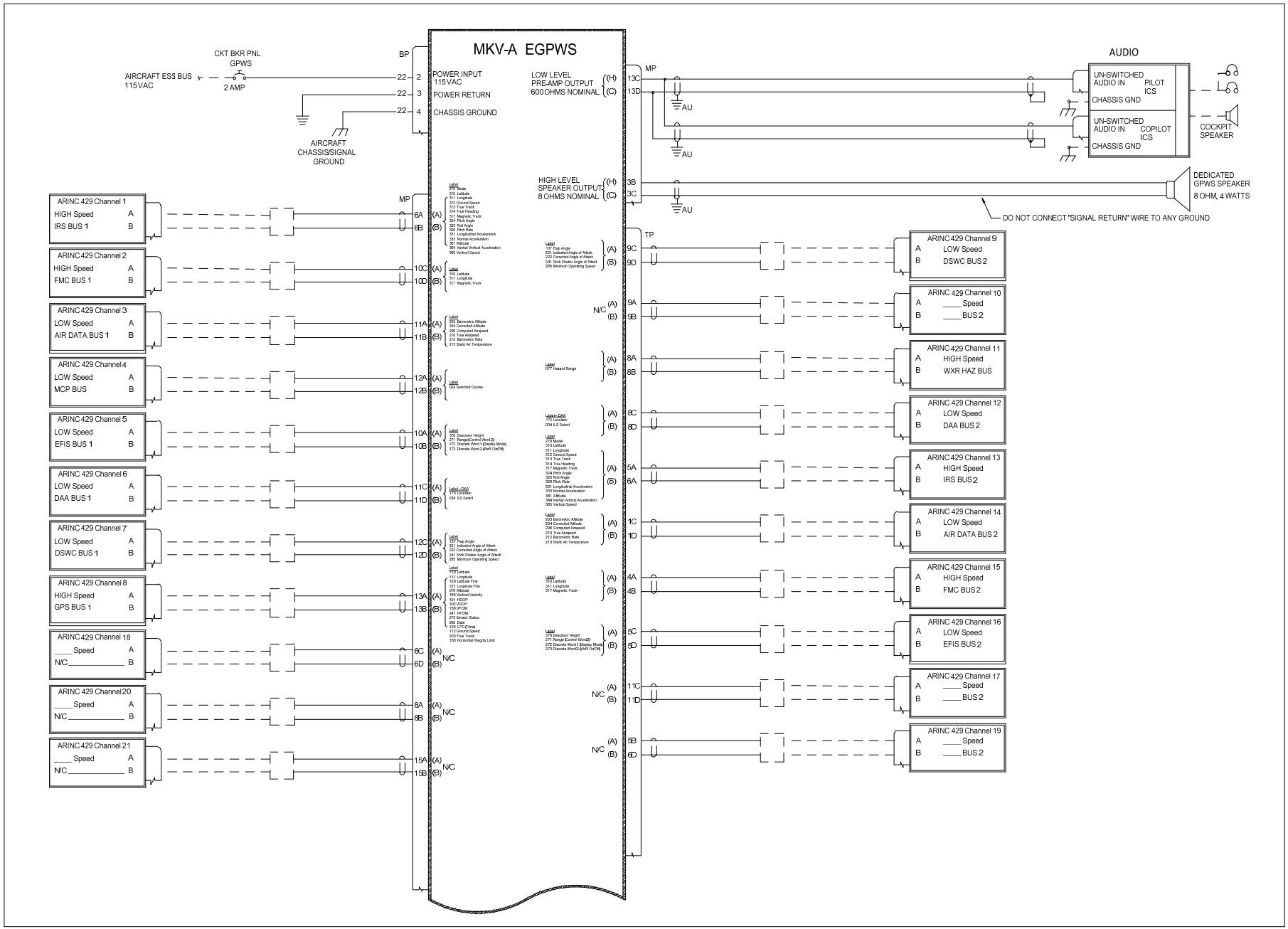


Figure A-1: Example ARINC 429 Parameter Source Inputs and Audio Output

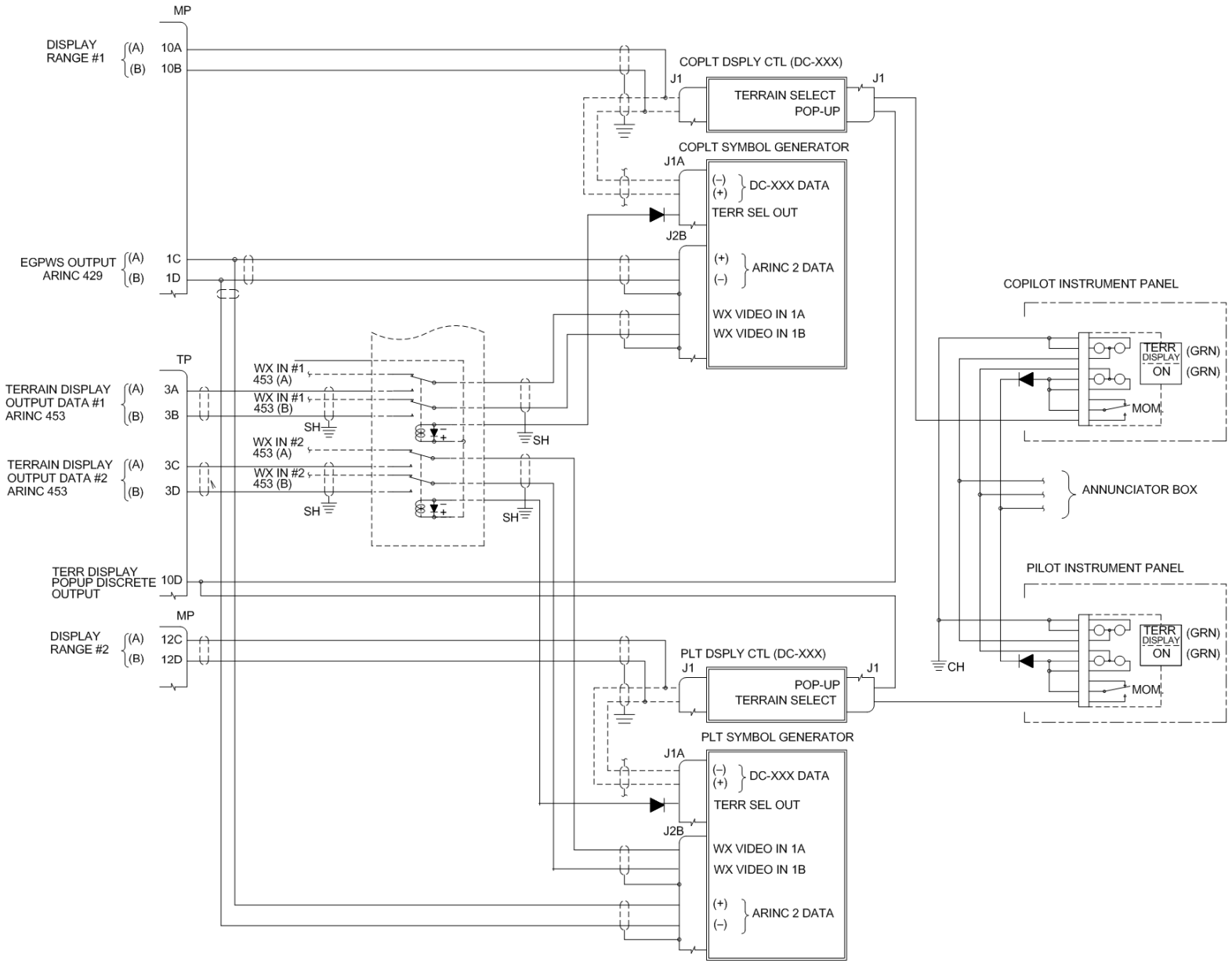
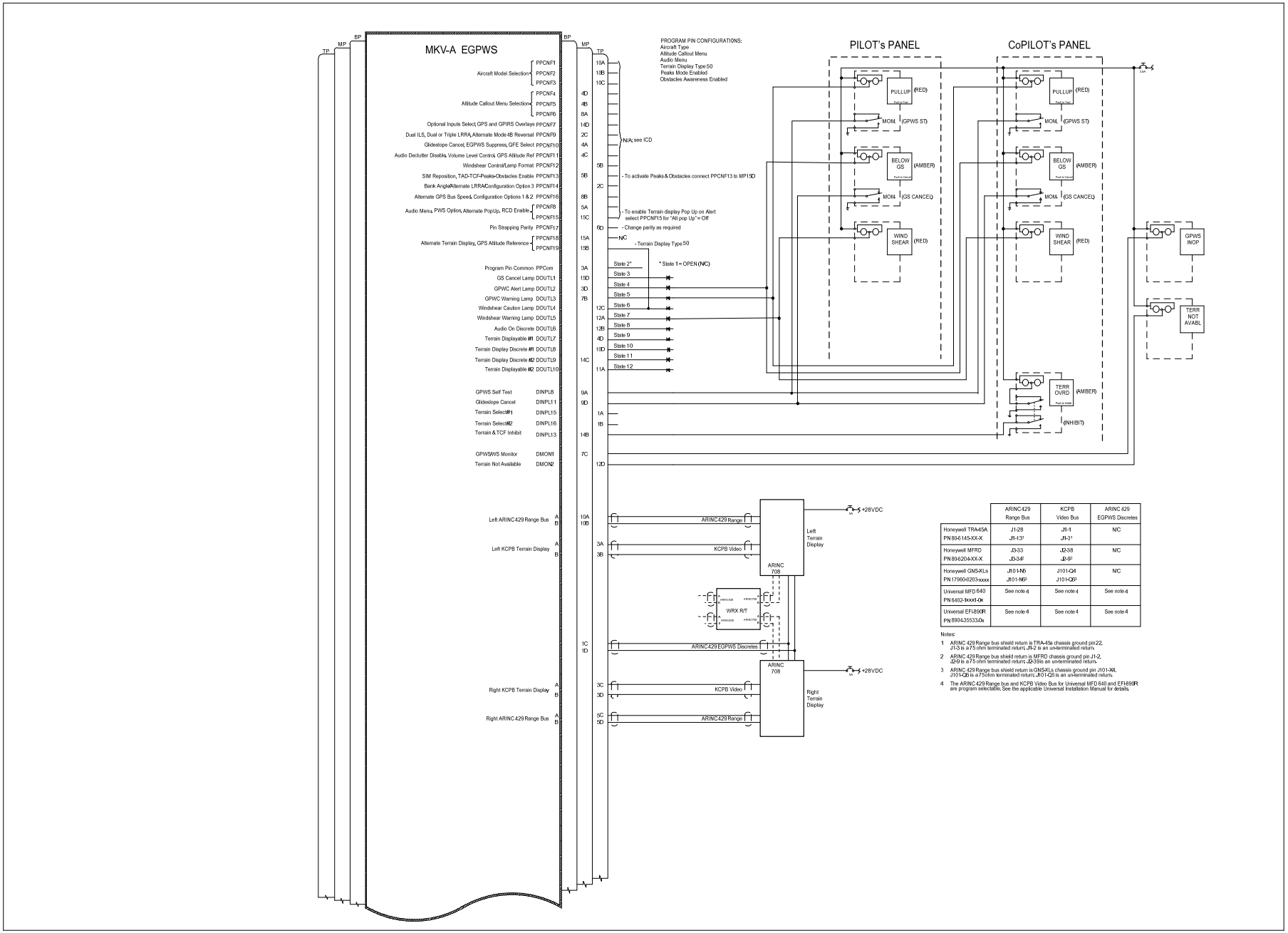


Figure A-2: Example Display Interface Using WXR/Terrain Switching Relay



	ARINC 429 Range Bus	KCPB Video Bus	ARINC 429 EGPWS Discretes
Honeywell TRA-45A PN 806-145-XX-X	J1-28 J1-13[1]	J1-1 J1-3[1]	N/C
Honeywell MFRD PN 806-204-XX-X	J3-33 J3-34[2]	J2-38 J2-9[2]	N/C
Honeywell GNS-XLs PN 17960-0203-xxxx	J101-N5 J101-N5[3]	J101-Q4 J101-Q5[3]	N/C
Universal MFD 640 PN 6402-1xxx1-0x	See note 4	See note 4	See note 4
Universal EFI 890R PN 8904-35533-0x	See note 4	See note 4	See note 4

Notes:
1 ARINC 429 Range bus shield return is TRA-45a chassis ground pin J2-2. J1-3 is a 75 ohm terminated return; J1-2 is an un-terminated return.
2 ARINC 429 Range bus shield return is MFRD chassis ground pin J1-2. J2-9 is a 75 ohm terminated return; J2-38is an un-terminated return.
3 ARINC 429 Range bus shield return is GNSXLs chassis ground pin J101-N4. J101-Q5 is a 75ohm terminated return; J101-Q5 is an un-terminated return.
4 The ARINC 429 Range bus and KCPB Video Bus for Universal MFD 640 and EFI 890R are program selectable. See the applicable Universal Installation Manual for details.

Figure A-3: Example EGPWS Outputs to Display, Indicator/Alert Lamps, and Inhibit Switches

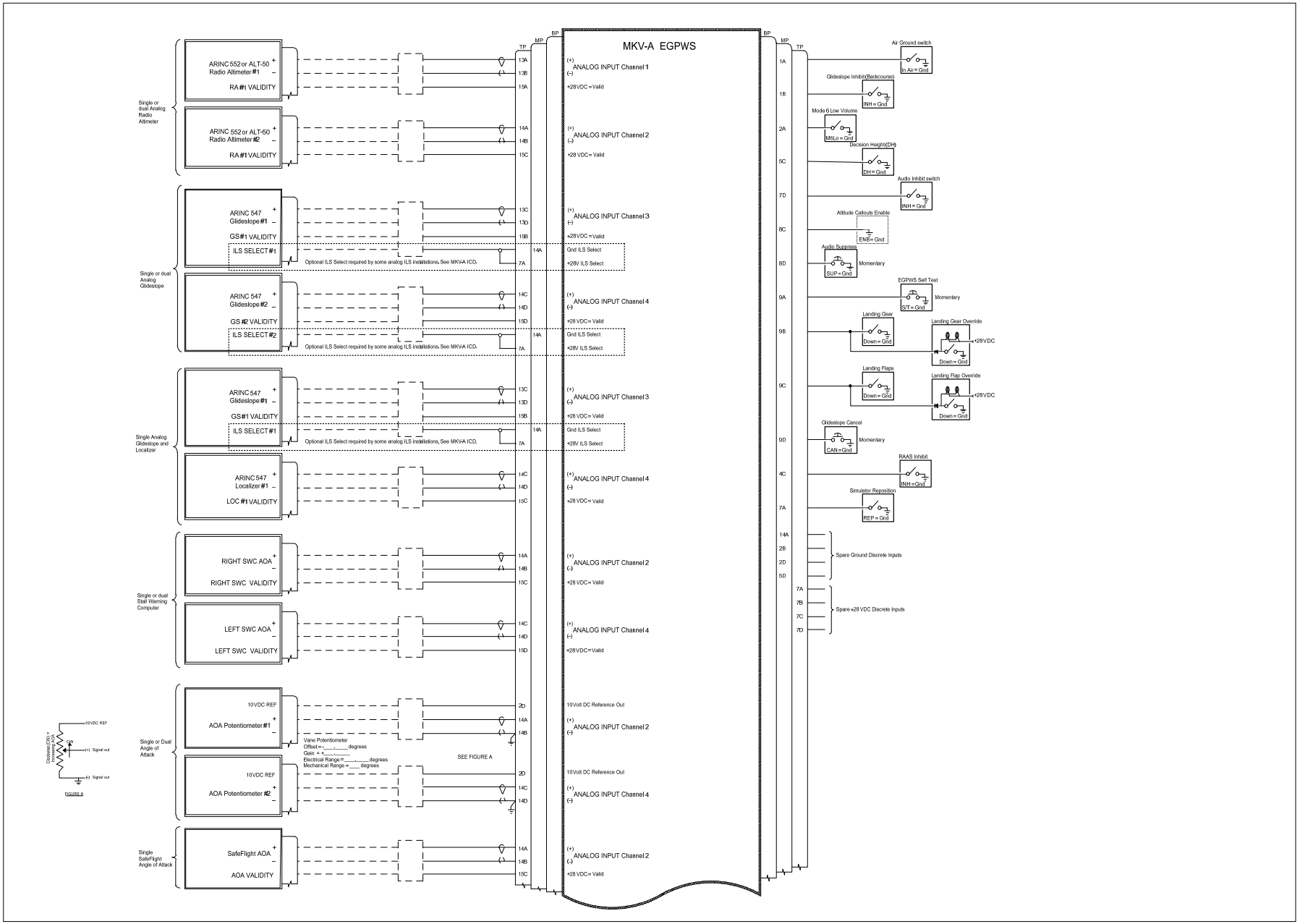
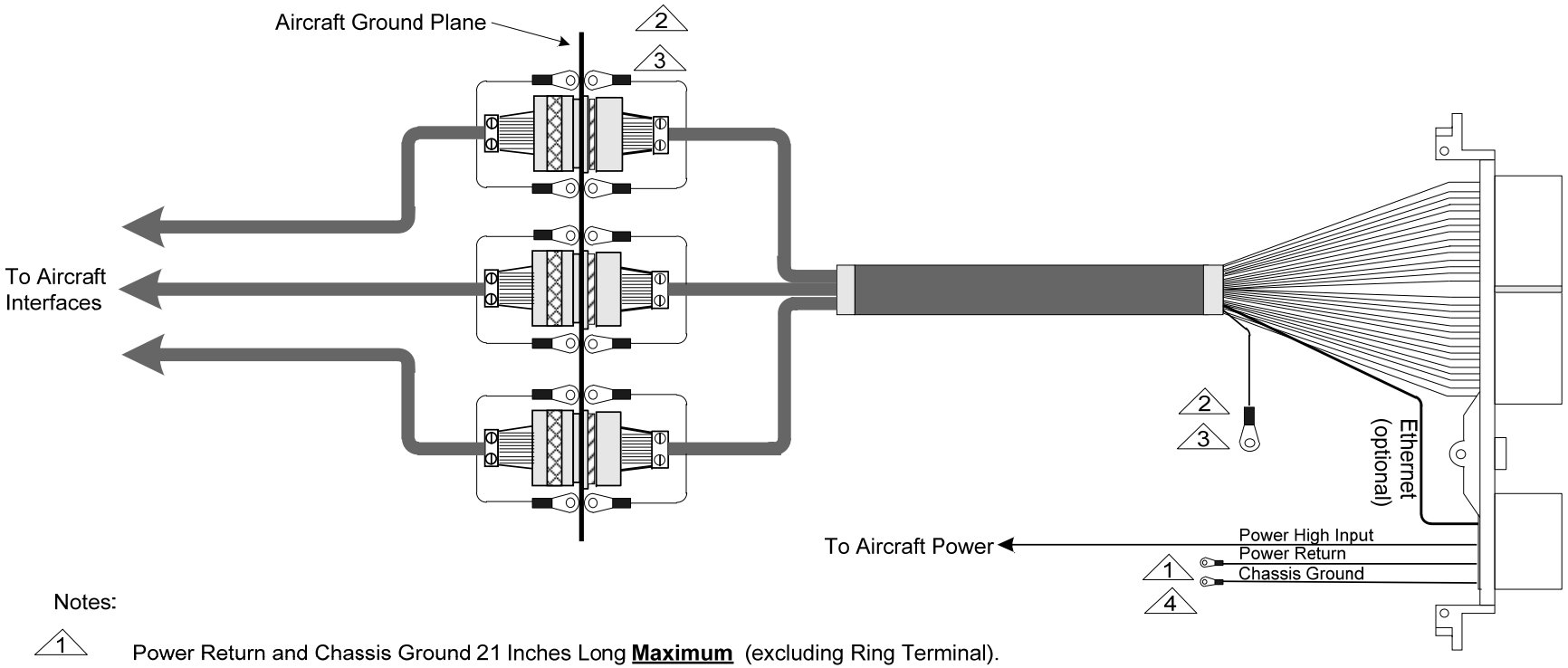


Figure A-4: Example EGPWS Analog Inputs and Discrete Input

Generic MKV-A Installation Cabling and Grounding Reference Diagram



Notes:

1. Power Return and Chassis Ground 21 Inches Long **Maximum** (excluding Ring Terminal).
2. Shielded Wire Ground Pigtails 20 Inches long **Maximum** (excluding Ring Terminal).
3. Connect Power Return, Chassis Ground and Shield Wire Ground Pigtails to the Aircraft ground plane.
4. Power High, Power Return and Chassis Ground wires to be 22 AWG minimum.
5. All wires are 24 AWG unless noted otherwise.
6. Shield Wire Ground Pigtails to be 24 AWG minimum.
7. All lengths are straight line measurements.
8. This is a generic reference drawing. Actual cable bundling and aircraft installation may vary as appropriate. Connectors, other than the MKV-A Aircraft Interface Connector are shown as a reference and are not required. Also, cable bundling as shown is for illustrative purposes only.

Figure A-5: Example EGPWS Cabling and Grounding

Appendix B: Ground Test Procedure

1.0 General

Accomplishment of the procedures in this section verify that the system has been properly installed.

It is assumed that the person(s) performing these tests has a working knowledge of the Honeywell MKV-A EGPWS installed in the aircraft. It is not necessary to follow the exact order of the test procedures as they are listed. It is up to the discretion of the person(s) performing the tests as to what order is the most logical to perform these tests.

2.0 Test Equipment

PC with MKV-A EGPWS BOSS software installed, Ethernet cable connected between PC and EGPWC, a compatible USB to Ethernet adapter may be used.

600Ω monophonic headphone with standard 1/4" audio plug (only needed if monitoring self-test audio from the EGPWC front panel headphone jack)

3.0 SOFTWARE, APD, AND RCD VERIFICATION

With PC connected, launch the BOSS program and run present status "PS" to verify: If a PC with BOSS software is not available, the part numbers can also be verified through the Level 3 Self-Test.

1. Verify that the correct application software is loaded.
2. Verify that the correct RCD is loaded (if applicable).
3. Verify that the correct APD is loaded (if applicable).

4.0 EGPWS SYSTEM SELF-TEST

The EGPWC Self-Test is divided into 6 levels as noted below.

Level 1	Go/ No Go Test
Level 2	Current Faults
Level 3	EGPWS Configuration
Level 4	Fault History
Level 5	Warning History
Level 6	Discrete Input test

4.1 Self-Test Initiation

Self-Test is initiated by pressing the **PRESS TO SELF TEST** button on the LRU front panel or from a **GPWS TEST** switch in the cockpit, as applicable. In the procedure below, wherever reference is made to "**GPWS TEST** switch", either the **PRESS TO SELF TEST** button on the LRU front panel or the **GPWS TEST** switch in the cockpit can be used.

A Short Level 1 Self-Test is a Go/No Go test for the system and is initiated by pressing the TEST switch for less than 2 seconds.

A Long Level 1Self-Test combines the short Go/No Go test with the enunciation of the entire EGPWS audio menu programmed for the aircraft. A Long Level 1 Self-Test is initiated by pressing and holding the TEST switch for more than 2 seconds.

NOTE: The Self-Test aural volume is 6 dB lower than the warning aural volume.

NOTE: GPWS FAIL, **TERRAIN FAIL**, and **WINDSHEAR FAIL** annunciators will illuminate during all levels of Self-Test.

4.2 System Self-Test

4.2.1 Self-Test Level 1 – Long Self-Test

Accomplish a system Self-Test per the following steps:

NOTE: Aircraft must be in a location that has an unobstructed field of view of GPS satellites to ensure the GPS receiver can navigate. The **TERRAIN FAIL** annunciator will be illuminated until the GPS receiver is properly tracking position. The initial position fix may take up to 20 minutes to acquire.

4.2.2 Level 1 Self Test

1. Apply power to the aircraft. Ensure all systems required by EGPWS are on and functional.
2. Ensure that **TERRAIN** is selected for display.
3. Press and hold down the **GPWS TEST** switch for more than 2 seconds.
4. Verify the following sequence:
   a. **GPWS FAIL** (Amber) lamp turns on
   b. **WINDSHEAR FAIL** (Amber) lamp turns on
   c. **TERRAIN FAIL** (Amber) lamp turns on
   d. **EGPWS** (Amber) lamps turn on
   e. Voice: "*GLIDESLOPE*"
   f. **EGPWS** (Amber) lamps turn off
   g. **G/S CANCEL** (Amber) lamp turns on momentarily
   h. **EGPWS** (Red) lamps turn on
   i. Voice: "*PULL UP*"
   j. **EGPWS** (Red) lamps turn off
   k. **WINDSHEAR** (Red) lamps turn on
   l. Voice: "(Siren) "*Windshear, Windshear, Windshear*"
   m. **WINDSHEAR** (Red) lamps turn off
   n. **WINDSHEAR** (Amber) lamps turn on momentarily
   o. Terrain test pattern is displayed on the Display
   p. **EGPWS** (Red) lamps turn on
   q. Voice: "***TERRAIN, TERRAIN, PULL UP***"
   r. **EGPWS** (Red) lamps turn off
   s. **EGPWS** (Amber) lamps turn on momentarily
   t. Voi**ce: *"RUNWAY AWARENESS OK FEET (or METERS)***" (if activated)
   u. **RAAS FAIL** (Amber) lamp turns on momentarily
   v. Voice: "***SINKRATE***"
   w. Voice: "***PULL UP***"
   x. Voice: "***TERRAIN***"
   y. Voice: "***PULL UP***"
   z. Voice: "***DON'T SINK, DON'T SINK***"
   aa. Voice: "***TOO LOW TERRAIN***"
   bb. Voice: "***TOO LOW GEAR***"
   cc. Voice: "***TOO LOW FLAPS***"
   dd. Voice: "***TOO LOW TERRAIN***"
   ee. Voice: "***GLIDESLOPE***"
   ff. Voice: "***BANK ANGLE BANK ANGLE***"
   gg. Voice: "***MINIMUMS***"
   hh. Voice: "***TWO HUNDRED***" (voices will depend on configured altitude callout menu)
   ii. Voice: "***ONE HUNDRED***"
   jj. Voice: "***FIVE HUNDRED***"
   kk. Voice: "***TOO LOW TERRAIN***"
   ll. Voice: "***CAUTION TERRAIN****, (long pause)* ***CAUTION TERRAIN***"
   mm. Voice: "***TERRAIN, TERRAIN PULL UP***"

nn. Voice: "***CAUTION OBSTACLE**, (long pause) **CAUTION OBSTACLE***"

oo. Voice "***OBSTACLE, OBSTACLE PULL UP***"

pp. **GPWS, WINDSHEAR, and TERRAIN FAIL** (Amber) lamps turns off

4.2.3 Level 2 Self Test – Current Faults

NOTE: The **GPWS FAIL, WINDSHEAR FAIL,** and **TERRAIN FAIL** (amber) lamps will be illuminated during the Level 2 Self-Test. The Level 2 Self-Test provides enunciation of all faults existing at the time of the test request.

1. Level 2 Self-Test is initiated by pressing the **GPWS TEST** switch to start the Level 1 Self-Test.
2. Once the Level 1 Self-Test begins, press and hold the **GPWS TEST** switch for less than 2 seconds. This will cancel the Level 1 Self-Test and start the Level 2 Self-Test.
3. Verify the following voice messages are annunciated:
   - "CURRENT FAULTS"
   - "NO FAULTS"
   - "PRESS TO CONTINUE"

NOTE: If the EGPWS Computer or system faults exist, the fault(s) will be annunciated as GPWS internal or external faults. The aural message will provide a description of the fault. If a fault is annunciated, it should be corrected prior to proceeding with the remainder of this procedure.

4.2.4 Level 3 Self Test – System Configuration

NOTE: The **GPWS FAIL, WINDSHEAR FAIL,** and **TERRAIN FAIL** (amber) lamps will be illuminated during the Level 3 Self-Test. The Level 3 Self-Test provides enunciation of the system configuration.

NOTE: "X's" listed below represent numbers or letters. Any enunciations are acceptable where "X" is listed below (e.g. the serial number maybe annunciated as "*SERIAL NUMBER 316*").

1. Press the **GPWS TEST** to start the Level 1 Self-Test.
2. Press the **GPWS TEST** switch to cancel the Level 1 Self-Test and start the Level 2 Self-Test
3. When you hear the message "Press to continue", press the GPWS TEST switch to start the Level 3 Self-Test.
4. Ensure the following messages (regardless of order) are annunciated:
   - *"SYSTEM CONFIGURATION"*
   - *"PART NUMBER"* 69000940-10X, 69000941-10X, 69000942-15X
   - *"MOD STATUS"* XX
   - *"SERIAL NUMBER"* XXXXX
   - *"SOFTWARE VERSION (PART NUMBER)"* XXX
   - *"APD VERSION (PART NUMBER)"* XXX
   - *"RCD PART NUMBER"* XXXXXXXX-XXX
   - *"TERRAIN DATABASE VERSION"* XXX
   - *"ENVELOPE MODULATION DATABASE VERSION (PART NUMBER)"* XXX
   - *"OSS CONFIGURATION FILE"* XXX
   - *"BOOT CODE PART NUMBER"* 69001906-XXX
   - *"AIRCRAFT TYPE"* XXX
   - *"AUDIO MENU"* X
   - *"ALTITUDE CALLOUT MENU"* X

Note: The messages listed below will only be heard if the option has been enabled or disabled from the basic configuration via program pin strapping or APD/OSS programming.

- *“ALTERNATE VOLUME 1 SELECTED”*
- *“ALTERNATE VOLUME 2 SELECTED”*
- *“CONFIGURATION OPTION 1 SELECTED”*
- *“CONFIGURATION OPTION 2 SELECTED”*
- *“CONFIGURATION OPTION 3 SELECTED”*
- *“LAMP FORMAT 2 SELECTED”*
- *“SMART CALLOUT SELECTED*”
- *“VISUAL SUPPRESS SELECTED”*
- *“AUDIO DECLUTTER DISABLED”*
- *“ALTERNATE MODE 6 VOLUME SELECTED”*
- *“QFE SELECTED”*
- *“ALTERNATE GLIDESLOPE CANCEL SELECETED”*
- *“OPTIONAL INPUTS SELECTED”*
- *“SINGLE GPS SELECTED”*
- *“DUAL GPS SELECTED”*
- *“SINGLE GPIRS SELECTED”*
- *“DUAL GPIRS SELECTED”*
- *“DUAL RADIO ALTIMETER SELECTED”*
- *“TRIPLE RADIO ALTIMETER SELECTED”*
- *“WINDSHEAR DISABLED”*
- *“WINDSHEAR CAUTION DISABLED”*
- *“WINDSHEAR CAUTION WITH VOICE SELECTED”*
- *“WINDSHEAR INOP DISABLED”*
- *“TERRAIN CLEARANCE FLOOR DISABLED”*
- *“TERRAIN AWARENESS DISABLED”*
- *“SIMULATOR REPOSITION SELECTED”*
- *“BANK ANGLE SELECTED”*
- *“ALTERNATE RADIO ALTIMETER 1 SELECTED”*
- *“ALTERNATE RADIO ALTIMETER 2 SELECTED”*
- *“ALTERNATE GPS BUS SPEED SELECTED”*
- *“PWS OPTION 1 SELECTED”*
- *“PWS OPTION 2 SELECTED”*
- *“BANK ANGLE OPTION 1 SELECTED”*
- *“BANK ANGLE OPTION 2 SELECTED”*
- *“ALTERNATE POP UP SELECTED”*
- *“PEAKS ENABLED”*
- *“GPS ALTITUDE REFERENCE WGS 84 SELECTED”*
- *“PITCH ALERT ENABLED”*
- *“MODE 6 LOW VOLUME SELECTED”*
- *“TERRAIN AWARENESS AND TCF DISABLED”*
- *“FMS GLIDESLOPE INHIBITED”*
- *“GLIDESLOPE INHIBITED”*
- *“STEEP APPROACH ACTIVATED”*

- *"STEEP APPROACH ENABLED"*
- *"STEEP APPROACH SELECTED"*
- *"IRS ATTITUDE MODE SELECTED"*
- *"OBSTACLE AWARENESS ENABLED"*
- *"OBSTACLE AWARENESS DISABLED"*
- *"ALTERNATE MODE 4B REVERSAL SELECTED"*
- *"ALTERNATE DISPLAY TYPE X SELECTED"*
- *"TERRAIN DISPLAY TYPE XX SELECTED"*
- *"RUNWAY AWARENESS ENABLED"*
- *"RUNWAY AWARENESS ENABLE SET"*
- *"RCD ENABLE SELECTED"*
- *"APPROACH MONITOR ENABLED"*
- *"APPROACH MONITOR INHIBITED"*
- "*FLAPS MONITOR ENABLED*"
- *"ALTIMETER MONITOR ENABLED"*
- *"LONG LANDING ENABLED"*
- *"AIRSPEED LOW INHIBITED"*
- *"ALTIMETER MONITOR INHIBITED"*
- *"PRESS TO CONTINUE"*

  If the switch is not pressed, self-test will be terminated.

4.2.5 Level 6 Self Test – Discrete Input Test

NOTE: The **GPWS FAIL, WINDSHEAR FAIL,** and **TERRAIN FAIL** (amber) lamps will be illuminated during the Level 6 Self-Test. The Level 6 Self-Test provides enunciation of changes to discrete inputs.

1. Press the **GPWS TEST** to start the Level 1 Self-Test.
2. Press the **GPWS TEST** switch to cancel the Level 1 Self-Test and start the Level 2 Self-Test
3. When you hear the message "Press to continue", press the **GPWS TEST** switch to start the Level 3 Self-Test.
4. Press the **GPWS TEST** switch for 5 seconds to cancel the Level 3 Self-Test.
5. When you hear the message "Press to continue", press the **GPWS TEST** switch to start the Level 4 Self-Test.
6. Press the **GPWS TEST** switch for 5 seconds to cancel the Level 4 Self-Test.
7. When you hear the message "Press to continue", press the **GPWS TEST** switch to start the Level 5 Self-Test.
8. Press the **GPWS TEST** switch for 5 seconds to cancel the Level 5 Self-Test.
9. When you hear the message "Press to continue", press the **GPWS TEST** switch to start the Level 6 Self-Test.
10. You will hear "*Discrete Input Test - Press to Cancel*" repeated every 60 seconds.
11. Select the **RAAS INHIB** switch.
12. The enunciations "***RUNWAY AWARENESS INHIBIT***" and "***APPROACH MONITOR INHIBIT"*** should be heard.
13. Deselect the **RAAS INHIBIT** switch.

14. The enunciations "***RUNWAY AWARENESS NOT INHIBIT***" and "***APPROACH MONITOR NOT INHIBIT***" should be heard.
15. Select the **TERRAIN INHIBIT** switch.
16. The enunciation "***TERRAIN OFF***" should be heard.
17. Deselect the **TERRAIN INHIBIT** switch.
18. The enunciation "***TERRAIN ON"*** should be heard.
19. Select the **GPWS FLAP OVRD** switch.
20. The enunciation "***LANDING FLAPS***" should be heard.
21. Deselect the **GPWS FLAP OVRD** switch.
22. The enunciation "***NOT LANDING FLAPS***" should be heard.
23. Depress and release the Pilot's **CANCEL GS** switch.
24. The enunciation "***GLIDESLOPE CANCELLED***" followed by "***GLIDESLOPE ENABLED***" should be heard.
25. Depress and release the Co-Pilot's **CANCEL GS** switch.
26. The enunciation "***GLIDESLOPE CANCELLED***" followed by "***GLIDESLOPE ENABLED***" should be heard.
27. Press the **GPWS TEST** switch to cancel the Level 6 Self-Test.

5.0 Analog Input Test

The procedure listed below tests a radio altimeter input. This is an example of a test for one type of analog sensor. The circuit breaker nomenclature and location are examples only and will vary according to the specific aircraft installation.

5.1 Radio Altimeter Interface Test

1. Make sure **GPWS FAIL, WINDSHEAR FAIL,** and **TERRAIN FAIL** lamps are NOT illuminated.
2. Open the 28 VDC circuit breaker, labeled Rad Alt, located in the R/H forward overhead C/B panel.
3. **Verify** the **GPWS FAIL** lamp illuminates.
4. **Verify** the **WINDSHEAR FAIL** lamp illuminates.
5. **Verify** the **RAAS INOP** lamp illuminates.
6. **Verify** the visual **RAAS-INOP** message is displayed on the terrain display.
7. Start the Level 2 Self-Test by pressing the **GPWS TEST** switch to start the Level 1 Self-Test.
8. Once the Level 1 Self-Test begins, press and hold the **GPWS TEST** switch for less than 2 seconds. This will cancel the Level 1 Self-Test and start the Level 2 Self-Test.
9. Verify the following voice messages are enunciated:
   - "*CURRENT FAULTS*"
   - "*GPWS COMPUTER OK*"
   - "*EXTERNAL FAULTS*"
   - "*RADIO ALTIMETER 1 WIRING FAULT*"
   - "*MODE 1 INOP*"
   - "*MODE 2 INOP*"
   - "*MODE 3 INOP*"
   - "*MODE 4 INOP*"
   - "*MODE 5 INOP*"
   - "*MODE 6 INOP*"

- "*WINDSHEAR INOP*"
- "*TERRAIN CLEARANCE FLOOR INOP"*
- *"GPW INOP*"
- "*PRESS TO CONTINUE"*

10. Close the 28 VDC circuit breaker, labeled Rad Alt, located in the R/H forward overhead C/B panel.
11. **Verify** the **GPWS FAIL, WINDSHEAR FAIL** and **RAAS INOP** lamps are off.
12. **Verify** the visual **RAAS-INOP** message is removed from the terrain display**.**
13. Start the Level 2 Self-Test by pressing the **GPWS TEST** switch to start the Level 1 Self-Test.
14. Once the Level 1 Self-Test begins, press and hold the **GPWS TEST** switch for less than 2 seconds. This will cancel the Level 1 Self-Test and start the Level 2 Self-Test.
15. Verify the following voice messages are enunciated:
    - "*CURRENT FAULTS*"
    - "*NO FAULTS*"

    "*PRESS TO CONTINUE"*

6.0 RAAS Inhibit Test

This test section should be accomplished if RAAS is enabled in this installation. The switch and indicator nomenclature is example only and may vary according to the specific aircraft installation.

1. Verify that all instruments are turned on.
2. Turn off source(s) of GPS position signals.
3. **Verify** that the **RAAS INOP** (amber) lamp is illuminated.
4. Press the **RAAS INHB/INOP** switch so that the INHIB (white) indicator is illuminated.
5. **Verify** the **RAAS INOP** (amber) lamp is extinguished.
6. Move the lamp test switch to the DIM position.
7. **Verify** all segments of the annunciator/switch dim along with the rest of the instruments.
8. Move the lamp test switch to the BRIGHT position.
9. **Verify** all segments of the annunciator/switch fully illuminate along with the rest of the instruments.
10. Press the **RAAS INHB/INOP** switch so that the INHIB (white) indicator extinguishes.
11. **Verify** the **RAAS INOP** (amber) lamp is illuminated.
12. Return the GPS position source(s) back to normal.
13. **Verify** the **RAAS INOP** (amber) lamp is extinguished.